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CHEMICAL & METALLURGICAL ENGINEERING

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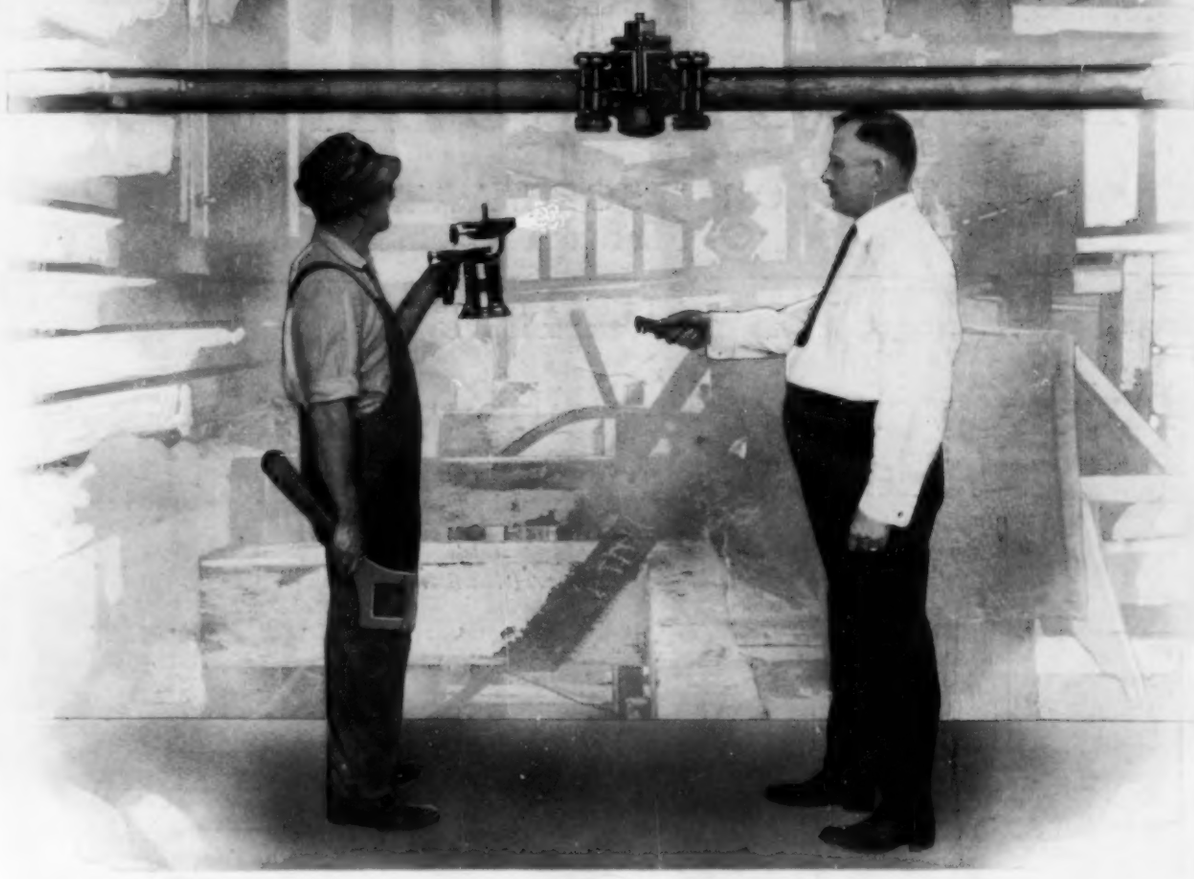

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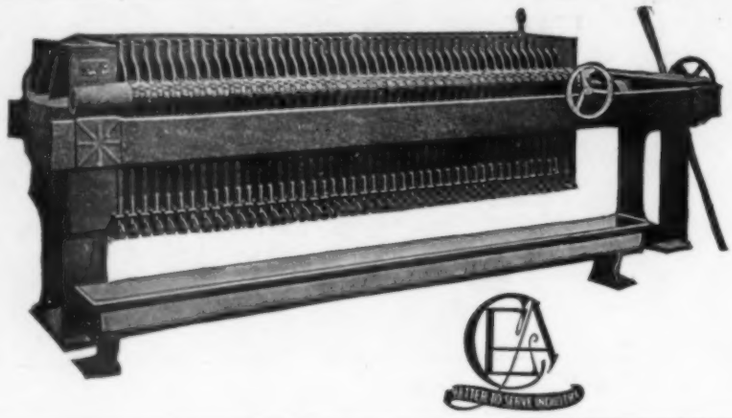

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CHEMICAL & METALLURGICAL ENGINEERING

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H. C. PARMELEE, Editor

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Uncertain Factors In the Coal Situation

INDUSTRY has shared the Nation's grief at the passing of our former leader. While this great national sorrow has been reflected in every line of human endeavor it seems to strike particularly close to one of the most urgent industrial problems which the nation is now facing. The coal situation, with its increasing maze of labor difficulties, is calling for our serious attention.

The public, irked by experiences of a year ago, is inclined to be impatient and is already beginning to look to the Government for definite action. If this were all that the situation required, it is the common belief of the layman that President Coolidge is admirably prepared to supply it. His firm stand at the time of the now-famous strike of the Boston police established a precedent that has been indelibly written into the minds of the American people. There is a growing feeling, however, that perhaps something more than decisive, executive action is necessary. Those who have studied the situation most intently are agreed that diplomacy will have to play a major rôle in the process of arriving at any permanent solution of the coal problem.

The very characteristics that most distinguished our dead President—his friendliness and intensely human sympathy—won for him the confidence of both capital and labor. If the coal problem had come to an issue that required his mediation there is little doubt but that the interested parties would have gladly rested their cases with him. And certainly the public would have continued their confidence in President Harding's calm and deliberate judgment.

Now the situation is changed. Should a crisis develop there would undoubtedly be great pressure from the public for governmental intervention. If this meant that the President was to be the final arbiter of our coal problem, it is believed that the United Mine Workers would be extremely hesitant in view of the President's former stand against unionism. On the other hand, there are those who see in this situation an opportunity for the President to demonstrate that he is not opposed to labor unions provided their claims are economically justifiable.

Those whose judgment of our coal problems is most respected hold to the view that a suspension in the anthracite mines is not immediately imminent. Still there can be no doubt that the present uncertainty combined with the stiffening resistance of the Mine Workers has brought about a situation of grave forebodings to industry.

What About Your Technical Staff?

"YOUR technical staff is an asset. Keep it alive, full of enthusiasm!"

This is the moral in our story of the Davison Chemical Co., the second half of which is published in this issue. In keeping with good story-telling form the moral comes at the end of our story but it is so immensely important that we believe it deserves frequent editorial emphasis.

Of course your average executive or board of directors will answer, "We know the technical staff is an asset. You aren't telling us anything. We wouldn't have one if we didn't think so." But actually they have little conception of its value, and when hard times come, *clip, clip,* will go the shears and the technical staff no longer exists. It has been thrown out along with the luxuries and the unnecessary expenses.

At Davison the attitude is different. Very few technical staff changes are made and in the troublesome times of 1921 there were mighty few losses—none that actually affected the size or the morale of the technical staff. What is the result? A technical staff with *esprit de corps*—a staff that can produce results—a staff of whom the officials have said:

"We could tell our competitors all of our secrets and in a year we would be ahead of them again because of our technical organization."

This corporation understands the significance of a technical organization, but in this they are the exception. How many men and companies are there who employ technical men and discharge them and get others; who have no conception of organization, no ability to organize, no appreciation of its value? Such men and companies are a menace for they have a wrong impression of the value of the engineer, the technologist, the operating man.

We recall a company that employs one man who is at once superintendent, chief engineer, employment manager, salesman, and purchasing agent all in one; yet this company has a technical staff in the best sense of the word. He is it—loyal, capable, enthusiastic and a real factor in an industry that is a monopoly. We know scores of plants where there are merely technical employees. There is no *esprit de corps.* There is no "staff"—just a group of dissatisfied individuals who would leave at the slightest provocation.

What is the answer? Are you getting the most out of your technical men? Are they a staff or a brilliant (perhaps), disorganized group? Are you making their interests and the interests of the corporation identical? Have you learned the Davison lesson?

Standards for Naval Stores

IN THE CLOSING HOURS of the last Congress a very important bill affecting naval stores was passed, establishing standard grades or classes of turpentine and rosin and providing for inspection of these commodities by the Department of Agriculture. The passage of this bill represented a distinctly forward step and furnished a climax to a sixteen-year fight for the enactment of appropriate legislation.

One of the most important features of the legislation is the fact that clear distinction in method of regulation is made between the standards for rosin and those for turpentine. In the case of gum and wood rosin, the thirteen color standards now widely accepted by trade practice are fixed by law as official designations and the Secretary of Agriculture alone is authorized to amend or add to these standards. Thus there is given official legal status to what has been hitherto simply good trade practice. In the case of turpentine, the various kinds or classes of this commodity are defined as "gum spirits," "steam-distilled wood turpentine," "destructively distilled wood turpentine," etc. Within these classes the Secretary may also fix grades or quality designations whenever "the interests of trade shall so require." Thus progress in commercial classification is to be recognized and advantage taken of the latest and best in technology.

Naval stores are produced in Southeastern and Gulf states extensively; but these materials are used largely in the Northeastern states, which consume from one-half to two-thirds of the production, the balance being exported. They represent very important raw materials in paper, paint and varnish, soap, and other industries. The fixing of clearly defined standards for quality is, therefore, a matter of wide interest. But the bill does not stop with that. It adds the provision that the Department of Agriculture may serve as referee in the analysis and classification of these materials, in order that there be no misunderstanding or commercial controversy as to the significance of specifications promulgated. Furthermore, in order that adulteration of turpentine may not be practiced, authority is given for the sampling of interstate shipments, inspection, and the publication of the results obtained. It is also provided that if evidence of adulteration be found, the facts shall be reported to the Department of Justice for appropriate action.

In the grading of rosin, there is, of course, ample ground for difference of opinion as to color matches. The law does well to recognize this fact and to state that reasonable discrepancies in this grading do not constitute adulteration. In the case of turpentine, however, the law considers as adulteration the admixture of any other constituents without clear designation of their presence in the case of subsequent sale. This distinction between unavoidable discrepancy in observations and the deliberate mixing for purpose of cheapening is a splendid one. It was not until this distinction was clearly recognized by the Department in its requests for legislation that the industry found the proposed law acceptable. Indeed, it was the failure to recognize this distinction between unintentional error of test and the intentional adulteration which so long delayed the enactment of this law.

As the law now stands, it defines practices that in general will be acceptable to all of the interested industries. It makes definite the best trade practices, thereby protecting the honest producer, the honest dealer and the purchaser against the unfair practice of those who might otherwise profit by sharp dealing. The establishment of a referee agency of an official sort to which appeal may be made in case of necessity, is also helpful. The industry will look to the Department for as generous and helpful administration of the law as is implied by the well-phrased provisions of the act itself.

Anthracite Screenings— An Economical Fuel For Industry

THE ANTHRACITE REPORT of the Coal Commission emphasized again an important phase of the fuel problem that has so far escaped the attention it deserves from industry. Of the total anthracite production in 1918, 31 per cent was of coal sized at ½ inch or less. This was distributed as follows: Buckwheat No. 1, 14 per cent (This is the size just below ½ inch); buckwheat No. 2, 7 per cent; buckwheat No. 3, 6 per cent; and combinations, 4 per cent.

Among the old-line companies the largest size, buckwheat No. 1, now has a circular (i.e., a quoted) price of $3.50 per ton at the mine. This is a size that is in fairly good demand, and the circular price, therefore, is not likely to be shaded. Buckwheat No. 2 is given a circular price of $2.50 at the mine but it is reported that a large contract was recently made at $1.75, while buckwheat No. 3 has recently sold as low as 75c. per ton. Below buckwheat No. 2 several small sizes are differentiated: Buckwheat No. 3 takes in ⅜-in. material, so-called "slush" goes down to 3/32-in. and material as small as ¼-in. is saved.

These smaller sizes are sold whenever there is a purchaser and generally the price is what they bring. This is notwithstanding the fact that the cost of production for all grades of anthracite will average around $5 per ton. The price of anthracite screenings is almost inevitably less than that of bituminous coal with which it must compete in industry. According to the super-power report 5 tons of anthracite screenings have the equivalent fuel value of 4 tons of bituminous coal and the freight rate per ton is practically the same.

These so-called fines are the byproducts, inevitably produced along with the larger size. If they are not sold they represent a tremendaus economic loss. Their utilization should be a matter of more common concern and our chemical engineering industries should be among the first to apply these materials in the scientific solution of their fuel problems. There are few, if any, technical difficulties that cannot be surmounted. The mines themselves burn these fines successfully in their own power houses firing either by stoker or by hand. A number of large industrial establishments and not a few of the railroads are consistent consumers of screenings and in general the practice has proved a real economy. Still another system is used in some plants where anthracite screenings are mixed with varying proportions of bituminous coal to give a satisfactory industrial fuel.

The industries that are doing this pioneer work in utilizing the wastes of the anthracite industry are making substantial savings in their own fuel budgets. But more important they are helping to raise the tremendous economic burden that exacts its toll from all fuel consuming industries.

Exercising The X-Ray

SELDOM is a new method of testing chronicled as a striking advance in technology and yet the course of more than one of our industries has turned on a significant development in the testing laboratory. The use of the polariscope in the sugar industry is a noteworthy example. Of a similar character, although perhaps in a more obscure stage of development, is the metallurgical industry's application of the X-ray.

In another place in this issue it is our privilege to present a notable contribution to the subject of metal testing. By an ingenious method of mounting specimens in liquid absorbent media, Dr. Ancel St. John of the Union Carbide and Carbon Laboratories, has greatly broadened the field for X-ray inspection of metals. His work opens up new possibilities in the maintenance of high-quality production—a factor, therefore, of intimate concern to both metal maker and user. Heretofore the use of the X-ray has been severely limited by the fact that only comparatively thin specimens of fairly uniform size and shape could be examined, at least without the use of rare and expensive equipment. By means of the technique now revealed it is possible to inspect miscellaneous products of irregular shape and thickness, quickly, and with a simple modification of the usual X-ray equipment. It is only necessary to surround the specimen with a medium, such as methylene iodide in benzine solution, which has a slightly different transparency to the X-rays and yet near enough to it to bring the transparency of the entire field into approximately the same order of magnitude. This method has the further and very appreciable advantage that this non-destructive inspection can be made on rough forgings, thus locating defects before money and time are lost in costly machining and fabrication.

The manufacturer will doubtless find routine X-ray examination a practical aid in the guarantee of metal quality. It can be put to work to effect dollars-and-cents savings in production. But it is the user of metal products who will be benefited most by the elimination of defects that too often result in expensive failures and damage to life and property.

The Research Engineer And Plant Personnel

A GOOD FRIEND of ours said not long ago that an analysis of most problems of industrial research would show them to be about 5 per cent technical, 5 per cent mechanical and 90 per cent education of personnel. The technical and mechanical difficulties of a project often prove easy of solution, when compared with the difficulty of translating it through the labor of men, into a commercial success. It is hard to sell a new method or process to those who must work it; a new idea finds many hurdles in its course through a shop.

Those who make up the personnel of an industry may resist change because of natural inertia, or from conservatism which sometimes amounts to the same thing. Or they may fight each innovation through a natural human fear for their jobs. Whatever the reason for this oft-encountered difficulty, it is a fact that to obtain a real commercial success for his work, the research engineer must have the enthusiastic co-operation of the men in the manufacturing department.

Those who have had their bumps and learned by experience how to meet this problem, know its importance to their success. They plan accordingly. At the risk of being accused of preaching we should like to offer some advice that may prove profitable to those who are just beginning their experience in industry. Whenever you plan anything consider its effect on the personnel. Work as closely to the men who must operate your processes as possible. Do nothing which may appear arbitrary or will tend to antagonize others. And, above all, make friends of the men in the plant with whom you come in contact.

MANY tempting morsels find their way to the editor's desk. In these days of publicity counsellors and advertising engineers the wooden nutmeg and the chocolate-coated onion are not the only forms of deception. Nor, for that matter, are unsolicited editorial wares always worthy of the credence that their conspiring authors would make you believe.

But really all this is beside the point for our purpose here is to share with our readers an unusual book review sent us by an enterprising British publisher with the courteous instructions: "Publication Kindly Requested." With apologies, the gem is reproduced herewith:

> Another unusually large volume of metallurgical information has just been issued by ————. The Expedition (sic.) with which the new book has been issued is very creditable. Similar American transactions usually appear a year or more after the meeting upon which they are based. So much for "Yankee hustle!" By the way, we understand from Dr. R———, F. R. S., recently returned from a 3-months lecture tour in the U. S. A. that there is nothing in America—or in the world for the matter of that—to compare with ———— which is regarded very highly by American metallurgists and engineers.
>
> The new volume well maintains the excellent standard of the past . . . covering every phase of metallurgical work and nearly every alloy. Any alloy that escapes mention in the papers is to be found—with the assistance of a magnificent index—in the wonderfully complete abstracts section. The latter section is a veritable treasure trove to all workers in and users of metals as, in fact, is the whole book.

And so much, too, for Yankee boastfulness as well as Yankee hustle! Both bid fair to be eclipsed once the Lion roars in earnest.

ANOTHER resplendent jewel, which has just come to hand, bears the very thrilling title: "The Wonder Romance of Borax." We had almost read it through when we discovered these significant paragraphs:

> Today, the fame and fortune of Mr. F. M. ("Borax") Smith is known throughout the world. The history of the fortune he amassed is remarkably illustrative of how easy it is to become rich from borax. * * *
>
> We judge the Future by the Past. History seems to invariably repeat itself. From these facts it is evident that the B—— Chemical Co. is destined to make a fortune for its stockholders.

Then we recalled some amusing correspondence we once had with the president of this company, whose literature tells us he "is a graduate electrical engineer, a member of the Sigma Xi Scientific Honor Society, a member of the American Institute of Electrical Engineers and a member of the American Chemical Society and the discoverer and patentee of the B——— Process of Solar Evaporation." He was kind enough, too, to send us a photograph of a frolicsome scene on the California desert which bore the caption:

> "Snow-balling" with Glauber's salts. Each "snow-ball" is worth 30 cents at a drug store. One "snow-ball" would make enough medicine to heal a hundred sick people and could be produced at a good profit to our stockholders.

Is Oxygen to Become a Commercial Possibility in Metallurgy?

A Problem of Tremendous Industrial Importance

IN THIS ISSUE we are proud to present for your consideration two abstracts of reports dealing with oxygen. The first is a report of a distinguished committee of Americans appointed at the request of the director of the Bureau of Mines by Mr. M. H. Roberts who acted as chairman. The Committee was asked to consider the general problem of the use of Oxygen or Oxygenated Air in Metallurgical and Allied Industries. The second is a monograph of the Institution of Chemical Engineers (British) by T. Campbell Finlayson of the Woodall Duckham Co., describing an investigation of the possibility of obtaining cheap oxygen.

The development of a process for cheap oxygen would precipitate a revolution in metallurgical practice. The revolution would be gradual but it would be complete. The striking fact, that in a blast furnace for every ton of iron produced three tons of nitrogen are passed through, will give at least some idea of the saving in thermal losses that would result from using an oxygen blast or a blast from highly oxygenated air. In the report it is pointed out that with a 40 per cent oxygen the increase in production will be 41 per cent and the decrease in coke consumption 30 per cent.

Such a revolution would involve the solution of many technical problems of major importance as subordinate to the main problem. One of these is refractories—at present the refractories are used practically to their maximum capacity. Higher temperatures in metallurgical processes would disintegrate existing refractories—yet here too there is evidence of progress in the right direction. New refractories of tremendous industrial promise are already approaching the manufacturing stage.

The problem is not new and the suggested use of oxygen in metallurgy has been made and discarded for the past twenty years. In the first place oxygen was too expensive. In the second place metallurgical practice could not be modified sufficiently. In the third place there were no refractories to stand the heat—a nice idea to be sure but visionary, impractical! We were actually in the position of the man who remarked: If I had some ham, I'd have some ham and eggs, if I had some eggs!

But now a brilliant report on the production of oxygen which though negotiative is promising. "No present process will give oxygen at 1s. per 1,000 cu.ft."—(This is about $4.26 per ton at present exchange.) Still further encouragement along this line by a sentence in the Bureau of Mines report suggesting oxygen at $3 per ton as a possibility. Then the report of the Bureau of Mines that elaborates the method of applying oxygen and oxygenated air to process—is it too much to look forward to the near approach of the time when cheap oxygen will be an accomplished fact and the production cost of metals will have been lowered significantly? Too much talk has made industry a good humored skeptic on this subject but this is no unsubstantial cry of wolf! wolf! It is a forward look from partly finished research. More power to the men who are back of such significant things.

Large-Scale Production of
Acid Phosphate
at the Davison Chemical Company's Plant

An Earlier Article Described the Production of Sulphuric Acid—Here the Problems of Design and Operation in the Manufacture of Acid Phosphate Are Discussed

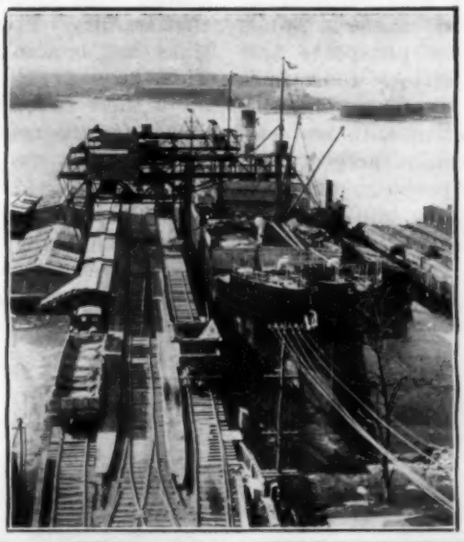
BY CHARLES WADSWORTH, 3d
Assistant Editor, *Chem. & Met.*

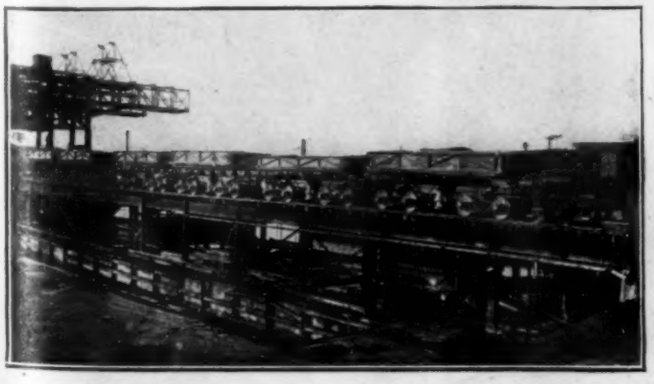
CHEMICAL ENGINEERING IN INDUSTRY

AN acid phosphate plant presents two fundamental and distinct but dovetailing problems. The first is the problem of design and layout and the second the problem of operation. It is of necessity true that any plant handling over a thousand tons of material a day must be designed with an eye single to the problem of proper flow of materials. That phrase "flow of materials" calls to mind always the delightful comment of the operator who overheard two engineers talking about the "flow of materials" being worked out in this plant. "Flow of materials, hell," remarked the operator, "look at the work we have to do on 'em and you call it flow." A diagram accompanying this article will make clear the layout of the plant. It is the general plan showing everything from the unloading dock to the shipping platforms. We shall follow the material through the plant, pausing long enough to hit some of the high spots.

The photograph of the unloading dock shows it to be a very different type from the pyrites dock with the monorail crane system described in the first article. Like the pyrites dock, it is about 400 ft. long. Steamers bearing phosphate rock are unloaded by means of two gantry cranes into dump cars on tracks. Each car holds 12 cu.yd. and can dump on either side of the track. Small 15-ton General Electric locomotives move these cars in from the dock over a track scales, where the weight is checked, to the dumping pits inside of the acid phosphate building. These locomotives are sturdy and stand the punishing work in good shape. By this system it is possible to empty a 5,500-ton boat load in 18 hours.

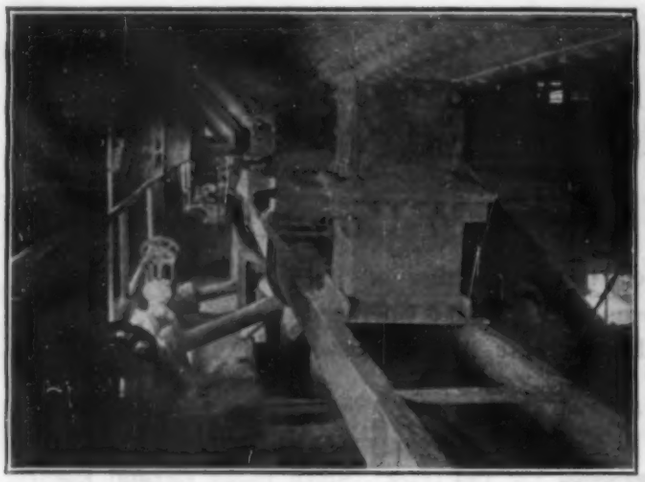
The acid phosphate building is an immense structure 375 ft. long by 60 ft. high split into four large bays. The construction is of steel reinforced by concrete buttresses to assist in withstanding the tremendous stresses existing in a shifting pole of stored material such as acid phosphate. As shown in the layout, to the left of the track as you come from the dock are the storage bins for rock, with a capacity of 18,000 tons, the mills for crushing the rock, the mixing units and dens (the latter is the technical name for the pits below the mixing units into which the freshly made acid phosphate is run as a mush). Parenthetically is should be noted that the Davison dens were the first concrete dens ever built. It was one of those things which just couldn't be done but was done. On the right of the track is the acid phosphate storage. This whole building is one problem in material handling. The main part of it is accomplished by means of four 15-ton





THE ROCK PHOSPHATE UNLOADING PIER

The top photograph shows the gantry cranes in action and steamer warped to dock in position for unloading. The photograph at left shows cars carrying rock from pier. They dump to either side by compressed air. Pistons can be seen in center of car carriage. At the right is another view of the pier, showing a diagonal perspective. Note scow for local handling in foreground.



DISCHARGE FROM THE GROUND ROCK STORAGE BINS. SCREW CONVEYOR IN FOREGROUND WHICH TRANSPORTS MATERIAL TO MIXING UNITS

THE MAW OF THE MILLS. PHOSPHATE ROCK HOPPERS ABOVE THE MILLS. ON THE RIGHT A GROUND ROCK HOPPER ABOVE THE MIXING UNITS

Cleveland traveling cranes—electrically operated and equipped with 3½-yd. clamshell buckets. This means about 4 tons of material (3 tons of acid phosphate or 5 tons of rock) at one bite. These cranes take the rock from the pits, where it is dumped from the cars, to the rock storage bins. As needed, the cranes move the rock from here to the hoppers that feed the mills, and again step into the picture when they empty the dens removing the acid phosphates to the storage piles. Finally, cars are to be loaded with acid phosphate or the hoppers which feed the bagging machines, and the cranes take care of these things too. These cranes boost every bit of phosphate first as rock and then as acid phosphate at least four times in the process of manufacture.

It is well to remember in connection with material handling problems that there are usually three or four satisfactory solutions to the same problem, but that to be "satisfactory" a system must be laid out with a primary thought to facility and flexibility of operation. That is the beauty of this system of handling phosphate rock and acid phosphate. With the gantry cranes and rock dump cars there is no great flexibility, but none is needed. Similarly in the case of the conveyors which move the pulverized rock from the storage bins to the mixing units, the only flexibility needed is feeding the mixing units when they are over different dens, and this is accomplished by means of different outlets of the conveyor or by reversing the conveyor. Considerable flexibility for operating is needed in the other steps, which include the elevation of the rock to storage and to the mill feed, emptying the dens and loading cars. For any one of these purposes the 15-ton cranes with 3½-cu.yd. clamshells would be oversize—that is, they will accomplish any of these tasks in less time than is actually required by operating conditions. This, however, is far from a fault, and the fact that all of these functions have been combined in the cranes makes for the needed flexibility.

The Mill Problem

The first thing that happens to the phosphate rock other than changes of location is grinding. The rock has been elevated in the clamshell buckets to the feed bins of the mills and is fed by gravity through a chute with a slide valve that regulates the rate of flow. This

Below—Mill casing, showing mill feed troughs and bottom of rock bins on the left. Center—Outside of the mill room, showing the air lift pipes and cyclone separators on the roof.

Below—The battery of exhaust fans, which supplies air for conveying ground rock to storage units.

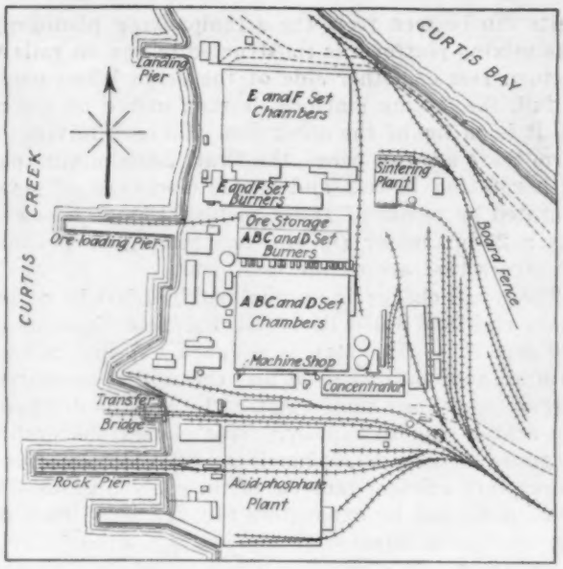


FIG. 1—PLANT LAYOUT

rate of flow is controlled by hand so that the electric current consumed stays at 75 amp. Experiments are being carried out on an automatic method of controlling the mill feed.

There are eleven Raymond mills of the roller type in the battery, each capable of grinding about 70 tons of material per 24-hour day, or a daily total of about 770 tons for the battery. This is a capacity of about 3 tons per hour per mill. They are direct connected to 550-volt, twenty-five-cycle, 75-hp. a.c. motors, an auxiliary belt being run from the shaft to operate the rock feed. The mill discharge flows to an air lift that both separates the ground rock and elevates it to the storage bins at the top of the building. The air is supplied by Raymond blowers, each operated by a 35-hp. motor. The fan speed is 1,450 r.p.m. and each one has a capacity of 9,000 cu.ft. per minute. Considerable cyclone!

Perhaps the most significant single thing about the grinding operation is the fineness. It is not customary to grind phosphate rock to anything like the fineness obtained at the Davison Chemical Co. Roughly 97 per cent of the material will pass through a 100-mesh screen and 80 per cent will go through 200 mesh. This is done advisedly, for it has been found that a faster and more complete reaction takes place upon mixing with sulphuric acid. Thus the fine grinding actually increases the production capacity of a given mixing unit.

From the mills the ground material is elevated as described to Cyclone separators, from which it flows into storage bins. The separators are placed high enough so that the bins will feed the mixing units by gravity and horizontal conveying. This is done by appropriately placed screw conveyors that feed from one to another and finally fill the weighing hoppers on the mixing units.

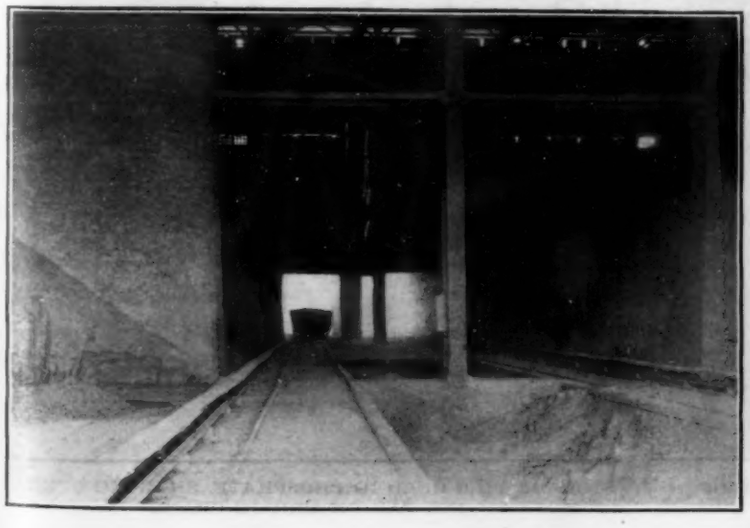
The Acid Phosphate Mixer

It is a peculiar feature of this industry that the main reaction—the mixing of sulphuric acid with acid phosphate—seems to be a mere detail. Several things contribute to this impression; first, the tremendous amount of work connected with the mechanical handling of the material, and second, the very short reaction time in the mixer—2 minutes. It is, however, a very important, carefully controlled reaction.

The reaction is carried out by first weighing the phosphate rock and then running the acid on top of it. Meanwhile the mix is being agitated. It becomes stiff rapidly and must be dumped into the den below before it becomes solid in the mixer. In this latter case a pickaxe and a crowbar are in order before the mixer can be put in commission again.

At the Davison plant the reaction is more rapid than is generally the case. This is partly due to fine grinding and partly to the fact that the acid is heated to about 120 deg. F. before mixing. Acid is blown over to storage tanks in the acid phosphate building from

BELOW—MOVING ROCK PHOSPHATE FROM PIER TO BUILDING. DUMP CAR IN THE REAR.
AT RIGHT—ROCK PHOSPHATE STORAGE BINS.



ACID STORAGE TANKS AT THE ACID PHOSPHATE BUILDING

the sulphuric plants and is heated in a two-stage heater with lead coils and exhaust steam. There are other factors which make reaction possible, not the least of which is an unusually close, careful and deft operation and chemical control.

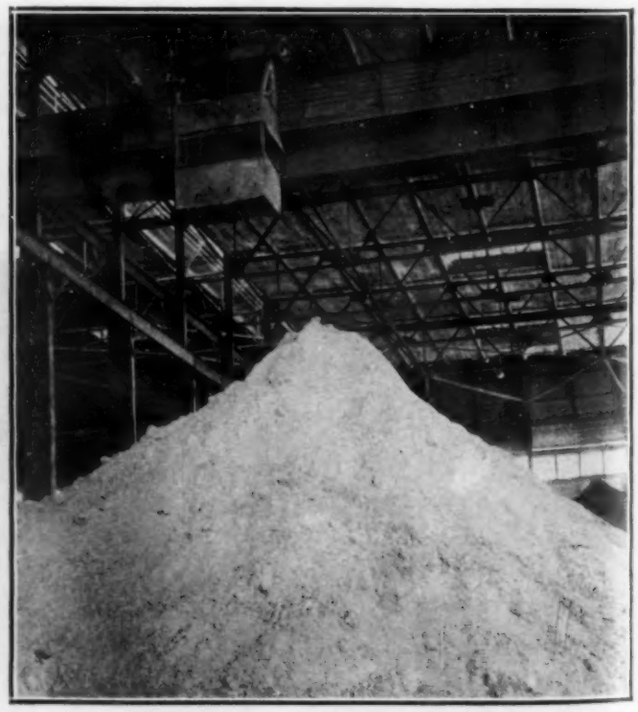
The actual set-up at the Davison plant consists of six concrete dens, rectangular in shape (19 ft. wide by 35 ft. long by 25 ft. deep), with a capacity of about 325 tons each. There are three mixing platforms, one for each pair of dens. The general features of the units can be seen from the accompanying photographs. The mixing platform is constructed to run on rails that in turn rest on either side of the den. When one den is full, the mixing platform is then moved on the rails till it is on top of the other den. On each mixing platform there are two pans—the Pratt 2-ton mixing pan—with rotating bottom and center discharge. They are operated by means of 10-hp. motors, though a new unit has a 25-hp. motor for the two mixing pans and the conveyors that are on the platform.

The usual charge is approximately 1,200 lb. of phosphate rock and 1,050 lb. of 53 deg. acid (measured at 120 deg. F.). The rock is weighed out into a hopper with an automatic shut-off and the acid is measured in a small lead-lined tank. After the rock is dumped in, the acid is run in rapidly. This causes the evolution of gases, notably hydrofluoric acid. Naturally this requires very efficient removal of the evolved gases. This is accomplished by exhausters through wood flues leading into large square wooden ducts. From here the gases are led to a recovery plant in which commercial products are developed from these byproducts. This part of the plant was not inspected.

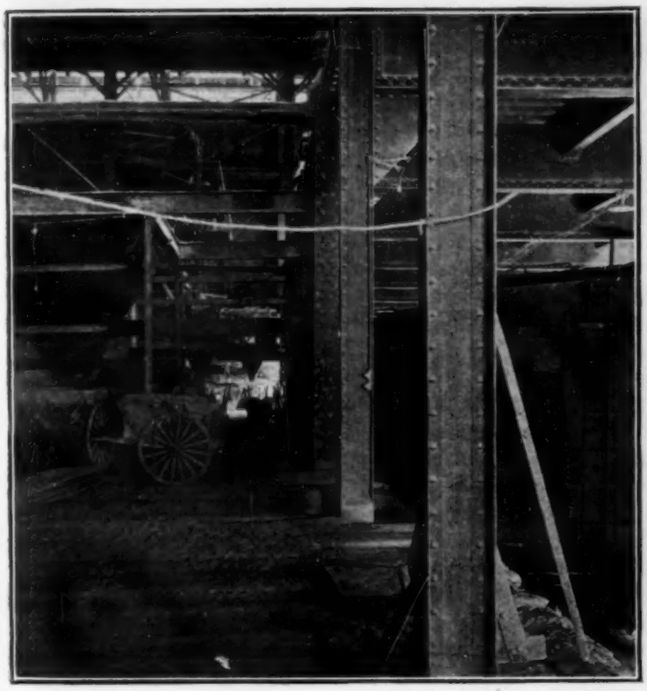
To return again to the mixing process, the charge is fluid for some seconds and then gradually begins to stiffen. It is very desirable to dump the charge at the point where it is so stiff that it can just be discharged. Then the reaction will be accelerated as much as possible by the stirring and the mixing will be carried to a point where it is as complete as can be. If this point is overreached, it has already been said that the mixture would set up solid in the pan and have to be broken out. To be able to hit this point requires considerable operating experience. The time is roughly 2 minutes per batch, for it is possible to run a den full (325 batches at roughly a ton per batch) in 8 hours.

The den has meanwhile been ventilated to draw off hydrofluoric acid and other evolved gases. After the den is full, it is allowed to stand for 5 or 6 hours (and

¾-CU.YD. CLAMSHELL TAKING A 5-TON BITE OF ACID PHOSPHATE



STORAGE PILE OF ACID PHOSPHATE, SHOWING OPERATING CAB ON BRIDGE CRANE



LOADING PLATFORM AND BAGGING MACHINE FOR HANDLING FINISHED PRODUCT

DUMP TRUCKS BY WHICH BULK MATERIAL IS LOADED INTO CARS FOR SHIPMENT AND LOADING HOPPER

longer if the plant is not operating to capacity), when it is attacked by the clamshell bucket and unloaded in less than an hour to the storage pile.

This ends the story except for the bagging machines, which are supplied with run of pile acid phosphate by the bridge crane.

The fines are separated from the lumps by Walker & Elliott shaking screens, the oversize passing into a Walker & Elliott disintegrator and returned to the screens. Sturtevant batch mixers with Sawyer revolving scales for bagging complete the equipment. The machines have a capacity of 25 tons per hour.

There is a moral to the story. It is the moral which is mentioned in the editorial pages of this issue. Keep

GENERAL VIEW OF ONE OF THE ACID PHOSPHATE BAYS. IN THE BACKGROUND A MIXING UNIT CAN BE SEEN ON TOP OF THE HOT DEN

your technical staff alive, alert, full of energy and enthusiasm. Having visited a dozen similar plants, we have no hesitation in backing Davison for that reason—a competitor could be given free access to all information the company has, and within a month or a year Davison would be ahead. If *Chem. & Met.* can drive home this single lesson in the next 50 years we shall have a stabler industry, a happier, more efficient, better appreciated technical fraternity, and foreign competition won't exist.

It is a pleasure to acknowledge our indebtedness to the Davison Chemical Co. Their plant was thrown open to us with complete generosity. A vital literature of chemical engineering would be easy to construct if we were given the same hearty co-operation that we received at Curtis Bay. To Mr. Ernest Miller through whose courtesy the visit was possible; to Messrs. Lednum Harvitt and McCredy who acted as collaborators and to Dr. Howes for the excellent photographs of the plant we wish to express our specific thanks.

A Heat Balance for Gas Producers

From a Discussion of Waldemar Dyrssen's Paper on "Gas Producer Practice in Steel Works."

By W. B. Chapman

President, Chapman Engineering Co., Mount Vernon, Ohio

THERE has been no concerted attempt in this country to establish a standard for a heat balance of gas producers. A number of persons have worked out a fairly complete heat balance for some isolated test, but the same method and constants have not been employed. I present here a heat balance which was worked out in our company as a suggestion of a standard method of making heat balances for gas producers.

In this heat balance we have not taken an isolated test of a gas producer. So often when one sees a test he has a feeling that it is exceptional and far from standard practice. We therefore took twelve different tests that were made on the four best-known mechanical producers—the Hughes, the Morgan, the Wood and the Chapman. We selected what we considered to be typical tests of first-class practice and averaged them together. We thus established a sort of standard of best practice in modern mechanical producers.

The average of these twelve tests shows 154 B.t.u., using of course the low or net heating values. I shall not go into detail, but I want to show you where the money goes that is spent for gas-producer coal. The debit side of the heat balance shows 97½ per cent of the energy put into the producer in the form of coal; the remaining 2½ per cent is in the form of steam. On the credit side there is 74.5 per cent in the form of cold producer gas and if you include the sensible heat in the gas, the efficiency is increased to 86 per cent. The remaining 14 per cent is lost. The losses are approximately 12 per cent due to radiation, 1 per cent from carbon in the soot, 1 per cent due to the cooling water and ½ per cent due to carbon in the ashes.

In most producer practice it is possible to run with the outgoing gas or top temperature lower and save 5 per cent or more of the coal by cutting down radiation losses. Some people make a great fuss about 1 per cent or less lost in the soot, or ½ per cent loss from carbon in the ash, while at the same time there is a needless loss of 5 per cent or more in radiation due to the top of the fire bed being too hot. This heat balance shows that more can be saved by keeping the top temperature low than in any other way.

There should be as great a differential as possible between the temperature at the top of the fire bed and at the bottom—that is to say, the gas maker should put on sufficient coal to make the fire bed thick and therefore cool on top to the point where the coolness of the gas makes trouble. Usually a temperature of the outgoing gases as low as 1,200 deg. F. is easily obtainable without increasing the proportion of steam in the air blast. All that is necessary is to keep the blowholes closed. At the bottom of the fire bed the temperature should be as hot as possible—that is to say, as hot as the coal will stand without melting the ash; if the ash melts it is pretty sure to result in trouble with clinker and other difficulties.

One should try as far as possible to maintain every horizontal plane across the producer uniform in two respects; it should be uniform in temperature and uniform in density. Not only in operating a producer but in selecting a new producer it should be borne in mind that horizontal uniformity throughout the entire contents of the producer is the end to be attained for efficient operation. If the ashes are removed unevenly—as they usually are—it starts blowholes, which destroy horizontal uniformity as regards both density and temperature. As soon as the blowholes open, the temperature rises in spots and clinkers follow.

Importance of Proper Ash Removal

If efficiencies are to be improved, much greater attention should be given to the question of even removal of the ashes to prevent uneven and violent disturbance in the fire bed. The majority of troubles in a gas producer start with uneven ash removal and therefore there should be as few restrictions as possible to a free and unimpeded downward movement of the ashes. I believe that continuous agitation of the ashes marks the most important immediate advance in gas-producer construction. In a gas producer efficiency and uniformity go hand in hand and one cannot obtain uniform conditions if the ashes have to be removed by a tortuous route impeded by restricted passageways. In some producers the ratio of the unimpeded space for the movement of the ashes downward to the total area of the fire bed is 70 per cent; in the others this ratio is 49, 45, 44, 32 and 18 per cent.

HEAT BALANCE OF AVERAGE GAS OBTAINED IN TESTS OF TWELVE DIFFERENT INSTALLATIONS OF MECHANICAL PRODUCERS

Six of the installations were of Chapman producers, two of Hughes, two of Morgan and two of Wood. All were typical of best practice. Compilation made by W. B. Chapman, President, Chapman Engineering Co.

Average analysis of gas (taken from tests of twelve different plants):

CO_2	O_2	CO	C_2H_4	H_2	CH_4	N_2	B.t.u.
4.8	0.2	25.5	0.4	12.1	3.6	53.4	154.0

Total combustibles in gas, 41.6 per cent.
Average coal fed per hour, 2,816 lb.
Average duration of tests, approximately 72 hours.
Coal used—gas coal mostly from Pittsburgh district.

Average Analysis of coal, as fired (at same twelve plants):

Moisture	Volatiles	Fixed Carbon	Ash	Sulphur in Ash	Total Carbon	B.t.u.
3.5	32.8	56.2	7.5	1.1	74.8	13,450

Notes: The amount of hand poking required in producers having continuous ash removal was about 15 minutes per 8-hour or 12-hour shift, but in producers having intermittent ash removal an additional poking to settle fire after each ash removal was required. No large or objectionable clinkers were made during the tests we have selected. Carbon in soot was not measured in all of the above tests but estimated to average 1 per cent of weight of coal fired. No allowance was made for undecomposed steam in gas except in figuring air used, as practically all moisture in gas was due to moisture in coal.

No account taken and no deductions made for tar vapor in gas as practically all of it passes on into the furnace and burns with high efficiency.

No account taken of mechanical power required to operate the different producers except to note that it averaged 3 hp.

Calculations made at or reduced to 62 deg. F. and 30 in. mercury.

Temperature of atmosphere at time of tests assumed to be 62 deg. F.

U. S. Steel Corp. revised low values used for gases at 62 deg. F. and 30 in. mercury as follows: CO 322, C_2H_4 1495, H_2 274, CH_4 909. Although the low or net values have been used in figuring the gas output, they have not been used in figuring the coal and steam input. This is because the net values are practically never used for coal and steam. The correct efficiency therefore would be greater than that shown.

In several of the tests complete data were not available and had to be either estimated or omitted from the averages.

HEAT BALANCE (summary)

Dr.	B.t.u.		Cr.	B.t.u.	
B.t.u. per lb. coal as fired	13,450 =	97.5%	Calculated power of gas	10,296.4 =	74.61%
Sensible heat of coal at 62 deg. F.	0 =	0.0%	Sensible heat of gas	1,575.9 =	11.42%
Sensible heat of steam above 62 deg. F.	350 =	2.5%	Losses Unburned carbon in ash	47.8 =	0.34%
Sensible heat of air at 62 deg. F.	0 =	0.0%	Unburned carbon in soot (Assumed 1% of coal fired)	133.4 =	0.97%
	13,800 =	100.0%	Sensible heat of ash 80 deg. F.	0.3 =	0.00%
			Sensible heat of cooling water	133.5 =	0.97%
			Radiation, etc. (by difference)	1,612.7 =	11.69%
				13,800.0 =	100.00%

Total losses, 13.97 per cent.
Efficiency of producer, hot gas, 86.03 per cent.
Efficiency of producer, cold gas, 74.61 per cent.

Coal gasified per square foot per hour	35.85 lb.
Steam used per lb. of coal	0.304 lb.
Gas per lb. of coal as fired	66.86 cu.ft.
Air per lb. of coal as fired	3.00 lb.
Cooling water per lb. of coal	1.78
Temperature of gas leaving producers averaged approx.	1,250 deg. F.

Producers equipped with 4- or 5-stage blowers with 9/16-in. nozzle or with steam turbo blowers.

CALCULATIONS FOR HEAT BALANCE

1. Calculation for volume of gas produced from 1 lb. of coal:

	Analysis of Gases Having Carbon		Wt. of Gas In Lb. Per Cu.Ft. At 62 Deg. F.		Proportion By Wt. of Carbon In Gas		Wt. Of Carbon Per Cu.Ft. Of Gas
CO	0.255	×	0.074	×	12/28	=	0.0081 lb.
CO_2	0.048	×	0.117	×	12/44	=	0.0015 lb.
CH_4	0.036	×	0.042	×	12/16	=	0.0011 lb.
C_2H_4	0.004	×	0.074	×	24/28	=	0.0003 lb.
Total lb. of carbon per cu.ft. of gas						=	0.0110 lb.
Carbon in 1 lb. of coal as fired (from analysis)						=	0.7480 lb.

$$\text{Volume of gas from 1 lb. of coal} = \frac{\text{C in coal—C in ash—C in soot}}{\text{C in cu.ft. of gas from anal.)}}$$

$$= \frac{0.7480—0.0033—0.0092}{0.110} = 66.86 \text{ cu.ft.}$$

2. Calculation of power of gas:

H_2	0.121	×	274	=	33.2 B.t.u.
CH_4	0.036	×	909	=	32.7 B.t.u.
CO	0.255	×	322	=	82.1 B.t.u.
C_2H_4	0.004	×	1,495	=	6.0 B.t.u.
					154.0 B.t.u. per cu.ft.

Heat value of cold gas from 1 lb. of coal = 154.0 × 66.86 = 10,296.4 B.t.u.

3. Calculation for sensible heat of gas at 1,250 deg. F.:

	Vol. of Gas		Mean Specific Heat Between 62 and 1,250 Deg. F.		Increase in Temp. 62 to 1,250 Deg. F.		
CO_2	0.048	×	0.0295	×	1,188	=	1.68 B.t.u.
O_2	0.002	×	0.0189	×	1,188	=	.04 B.t.u.
CO	0.255	×	0.0189	×	1,188	=	5.73 B.t.u.
H_2	0.121	×	0.0193	×	1,188	=	2.77 B.t.u.
C_2H_4	0.004	×	0.0454	×	1,188	=	.21 B.t.u.
CH_4	0.036	×	0.0359	×	1,188	=	1.53 B.t.u.
N	0.534	×	0.0183	×	1,188	=	11.61 B.t.u.
Sensible heat of gas per cu.ft.							23.57 B.t.u.

Sensible heat of gas from 1 lb. of coal:
23.57 × 66.86 = 1,575.9 B.t.u.

4. Calculation of amount of coal gasified per sq.ft. per hr.:

$$\frac{\text{Wt. of coal per hr.}}{\text{Producer area}} = \frac{2,816}{78.54} = 35.85 \text{ lb. per sq.ft. per hr.}$$

5. Calculation of sensible heat in 1 lb. of coal:
Sensible heat in 1 lb. of coal =
0.22 (sp.ht.coal) × 0 (degrees above 62 deg. F.) = 0.0 B.t.u.
Note: This calculation is given to show method to be employed when average temperature during time of test is other than 62 deg. F.

6. Calculation of loss from unburned coal:
Ash from coal by analysis, 7.5 per cent.
Per cent of carbon in refuse from producer, 4.2 per cent.
Total carbon unburned per lb. of coal =

$$\frac{0.075}{1—0.42} \times 0.042 = 0.0033 \text{ lb.}$$

Loss from carbon in ash = 14,500 (value of carbon) × 0.0033 = 47.8 B.t.u.

7. Calculation of loss due to carbon in soot:
Quantity of soot assumed to be 1 per cent of weight of coal and to contain 8 per cent ash and 92 per cent carbon.
Loss of carbon in soot = 0.0092 × 14,500 (B.t.u. in C) = 133.4 B.t.u.
Note: It is assumed that the soot contains no tar, as the amount of condensed tar vapor is usually well under 1/10 of 1 per cent.

8. Calculation of loss due to sensible heat of ash:
Refuse = ash 7.5 per cent + carbon in ash 0.33 per cent = 7.83 per cent
Specific heat of ash, 0.2.
Temperature of ash, 80 deg. F.
0.0783 × 0.2 × 18 (degrees above 62 deg. F.) = 0.28 B.t.u.

9. Calculation of amount of steam used:
Diam. of nozzle = 9/16 in. Area of orifice = 0.25.
Steam pressure, 52 lb. gage; 66.7 lb. absolute.
Napier's approximate formula steam per hour =

$$\frac{3600 \times \text{absolute pressure} \times \text{orifice}}{70}$$

$$\text{Steam used per hr.} = \frac{3600 \times 66.7 \times 0.25}{70} = 857.4 \text{ lb.}$$

$$\text{Lb. of steam per lb. of coal} = \frac{857.4}{2,816} = 0.304$$

Note: In Napier's formula steam is assumed to be dry, but it usually contains 3 or 4 per cent moisture, which would make its weight somewhat greater than indicated by this formula. For exact work a throttling calorimeter should be used. The error, however, is offset by the fact that the steam gage is usually located some little distance from the nozzle.

10. Calculation of sensible heat of steam:
Heat content (above 62 deg. F.) of saturated steam at 52 lb. gage pressure. = 1,150 B.t.u. per lb.
Sensible heat of steam = 0.304 × 1,150 = 350 B.t.u. per lb. of coal.

Note: No determination has been made of the amount of moisture in the gas This consists of undecomposed steam from the blast and of moisture from the coal as fired. If the gas is of good quality (having under 5 per cent CO_2 and over 25 per cent CO), the moisture from undecomposed steam is small. We have assumed it to be 10 per cent of total steam used. If desired the moisture can be obtained accurately by the use of a psychrometer.

11. Calculation of amount of air and sensible heat of air:

Per Cent of Gas	Gas Per Lb. Coal	Wt. Gas Lb. Per Cu.Ft.	Proportion Of Oxygen	
0.048	× 66.86 ×	0.116	× 32/44 =	0.271 lb. oxygen
0.255	× 66.86 ×	0.074	× 16/28 =	0.721 lb. oxygen
0.002	× 66.86 ×	0.084	× 1 =	0.011 lb. oxygen

Amount of oxygen in gas from 1 lb. of coal, 1.003 lb.
Amount of oxygen in 1 lb. coal (from analysis), 0.071 lb.
Oxygen supplied by air and steam blast, 0.932 lb.

$$\text{Oxygen supplied by steam blast} = \frac{16}{18} \times .304 = 0.270$$

Deducting 10 per cent (assumed to be undecomposed) = 0.270—0.027 = 0.243 lb.
Oxygen supplied by air blast, 0.689 lb.

$$\text{Air per lb. of coal, } 0.689 \times \frac{100}{25} = 3.00 \text{ lb.}$$

3.00 × 0.2374 (sp.ht. air) × 0 (degrees above 62 deg. F.) = 0.0 B.t.u. sensible heat of air per lb. of coal gasified.
Note: This calculation is given to show method to be employed whenever the average atmospheric temperature during the time the test is made is other than 62 deg. F.

12. Calculation of sensible heat of cooling water:
10 gal. cooling water used per minute = 83.3 lb.

$$\text{2,618 lb. coal per hr.} = \frac{2,816}{60} = 46.9 \text{ lb. per minute.}$$

$$\text{Cooling water per lb. of coal} = \frac{83.3}{46.9} = 1.78 \text{ lb.}$$

Specific heat of water = 1.0.
Temperature of ingoing water 55 deg. F. Temperature of outgoing water 130 deg. F., hence increase of temperature = 75 deg. F.
Sensible heat in cooling water per lb. of coal = 1.78 × 75 × 1 = 133.5 B.t.u

Study of Ozone Demands Determination in Air

In the past few years the question of utilizing ozone for purifying air in ventilation of buildings, and also the air of refrigerating plants, has been receiving much attention. In the past the expense of production has been a great drawback to its extensive use. The electrolytic method has been considered standard for several years. Ozone being a rare gas, with active oxidizing powers, may be used for the purifying of air used in ventilating public buildings, for removal of odors and for destroying bacteria. Its use has also been proposed for bleaching textiles and sterilizing them. The Department of the Interior, through the Bureau of Mines, is co-operating with the Society of Heating and Ventilating Engineers in four important problems: (1) Methods for quantitative determination of ozone and oxides of nitrogen in ozonized air; (2) Amounts of concentration that will produce the desired results, and the limiting amounts permissible to breathe without harmful effects; (3) Tests of ventilation systems using ozonized air; and (4) Use of ozone in connection with recirculation of air in buildings. The Department of Interior, through the Bureau of Mines, has worked out a method for determining oxides of nitrogen produced by ozone apparatus, by which it was shown that these oxides were not produced in harmful amounts in ventilation apparatus.

Increasing Production Efficiency With

Oxygen in Metallurgy

This Article Is Composed of the Most Important Abstracts from the Report of the Committee for the Application of Oxygen in Metallurgical and Allied Industries. Mr. M. H. Roberts Appointed This Committee. F. W. Davis Prepared the Report

IN THE PAST it has been considered essential that our higher grade raw materials should be utilized in the manufacture of many products, especially in metallurgical processes, but now that we are confronted with diminishing supplies of such materials, we have been forced to use what were once considered undesirable and practically valueless. This condition will become more accentuated as time passes, and we have got to meet it by improving methods so as to utilize the lower grade supplies; and make a product as good and as cheaply and efficiently as from the richer materials. With each development of this character we are not only conserving our resources by eliminating waste, but we are also increasing our reserves by the quantity of lower grade material which responds to such improved methods. For instance, by eliminating impurities from fuel and iron ores we are enabled to work beds of such materials once condemned as unsuitable for any purpose.

Recent developments in oxygen production seem to indicate that oxygen can be supplied in large quantities at a cost not to exceed $3 per gross ton. Based on this figure, a report has been prepared indicating some of the substantial economies to be effected through the application of oxygen or oxygenated air to: Blast-furnace smelting of iron; bessemer and open-hearth processes for steel; manufacture of artificial gas; blast furnace smelting of ferromanganese.

The trend of development in smelting and refining is in the elimination of inert matter—that is, material (solid or gaseous) which does not enter into the reactions in the furnace, and which simply passes through, absorbing and carrying away heat and reduced metals therefrom, a heat that otherwise would be utilized in the process. For instance, in making iron in the blast furnace, a process is still employed in which the inert material greatly outweighs the active material, as can be illustrated by the fact that in the production of one ton of pig iron three tons of nitrogen is passed through the furnace. The same is more or less true of all furnace operations which derive heat from the combustion of fuel by atmospheric air. It would seem, therefore, that metallurgical technique, as well as the conservation of our natural resources, would be greatly advanced if the nitrogen passing through the furnace could be diminished. This might be done by substituting oxygen, or a mixture of oxygen and air, for the air now used, and the following discussion shows the possibilities of the application and efficiency of oxygen to some phases of ferrous metallurgy as it exists today.

No claim is made that this is a new or novel idea, because the possibilities of using a higher oxygen mixture for combustion have been discussed by eminent scientists for the past 15 or 20 years; and the consensus of opinion is that great economies would result from such a process. Moreover, a number of discussions have been published on this subject, most of which assert the desirability of this step, but a few doubted that the objective could be accomplished. These objections, however, are based on the possible application of highly enriched air to present processes, but when we consider that current methods have been developed around the combustion of fuel by air as a fundamental basis, we could hardly expect to obtain the best results without materially changing these processes. Doubtless, the only reason that such changes have not been made is on account of the inability to produce oxygen in quantities at sufficiently low cost, to make such application industrially possible.

In view of the many recent developments in oxygen manufacture, and considering the increasing cost and decreasing quality of our raw materials, the Bureau of Mines, Department of the Interior, has taken the matter of the application of oxygen or oxygenated air to the metallurgical centers for consideration, and has appointed an Advisory Committee to study the problem.

This committee has made a thorough survey of the existing processes for the manufacture of 99 per cent oxygen. The conclusions reached by this survey are that the comparatively small demand for the product has prevented the installation of large units suitable for metallurgical processes, with corresponding economies, and by far the greater proportion of the present cost of oxygen represents the cost of transportation, storage and service. Large oxygen manufacturing plants can be built to serve metallurgical purposes directly, which, by virtue of their large production and correspondingly increased efficiency, together with the fact that no compression in cylinders, storage, transportation, or service will be required, will be capable of delivering oxygen for the processes at a cost not to exceed $3 per gross ton. In other words, the Committee finds that the oxygen industry is now able to make plants for supplying large quantities of oxygen to metallurgical industries at low cost.

The Committee has made studies of the possible application of oxygen to ferrous metallurgy in general,

to the metallurgy of zinc, to the manufacture of fuel gas, and for some miscellaneous industrial uses. The findings of the Committee on these theoretical studies are of such a revolutionary character that the members feel the strong advisability of conducting experimental work to verify the truth thereof, as well as to make changes in furnace design and processes in order to take full advantage of the probable benefits to be gained.

The committee has developed plans for experimentally determining the effects of oxygen enriched air upon the operation of the blast furnace, and it recommended that these plans be put into effect as the first step of an extended research upon the general applicability of oxygen to metallurgy.

To show the findings of the committee and its studies in detail would require lengthy and tedious calculation, which, for brevity, will be omitted. However, certain studies of the application of oxygen will be presented, which, while they do not necessitate radical changes in present equipment, still show such savings as to warrant further investigation. It must be remembered, however, that these are only introductory studies in which we are limited as to the possible advantages to be obtained by the fact that we are using equipment designed to use air with 77 per cent by weight inert matter, namely, nitrogen.

The savings and refinements given later refer only to the major processes, no mention being made of the value to any iron or steel plant of a supply of available oxygen for miscellaneous purposes, such as for cutting, welding, etc. We are inclined to believe that oxygen as generated for a blast-furnace or open-hearth furnace would find many sundry uses around the plant, some of which cannot be predicted today; but in the aggregate, this use would result in a great saving when comparing the cost of compressed oxygen with that of oxygen made direct, and simply piped to the point of consumption.

While the report is strictly one on ferrous metallurgy, the files of the committee show great economies in the metallurgy of zinc. Copper has not been studied in detail yet, but promises to show similar economies to those for zinc. In fact, we feel that all non-ferrous metallurgy will be benefited by the use of cheap oxygen. The ceramic industry will also be made more efficient, especially in the manufacture of super-refractories, which require very high temperatures.

The metallurgical calculations used in the report to arrive at the conclusions which follow, conform as nearly as possible to accepted theories of the process involved, and the results of these calculations agree with practical operations where present processes are concerned. But while the general results do agree with practical conditions, it is believed that some of the actual reactions involved may not exactly correspond to the theories as given here. However, it did not seem advisable to introduce any new theories until there is a better understanding of these reactions.

Application of Oxygen to the Smelting of Iron

The matter of increasing the oxygen content of the air blown into the iron blast-furnace has probably received more discussion than any other proposed metallurgical application of oxygen. The fact, however, that oxygen has always been an expensive commodity has done much to prevent any real analysis being made of the effect of this practice, so that published opinions, being opinions only, differ greatly from one another as to the ultimate result predicted. However, by a careful analysis of both the metallurgical and thermodynamic principles involved, we may predict with some accuracy the effect on furnace operation of such changes.

Doubtless the application of oxygen will revolutionize the art of smelting and it will probably change the whole operation and equipment. However, in order to demonstrate the value to the industry of a development of this character, it seems advisable first to adapt the process to present-day equipment. The first thought was to supply a furnace with blast of 40 per cent oxygen, but in this practice there would be insufficient reducing gas, and it would be necessary to recirculate a portion of the top gas. It is estimated this would increase the tonnage by 41 per cent and decrease the coke consumption by 30 per cent. However, in view of the fact that due to the deficiency of carbon monoxide in the top gas, circulation of this gas would be necessary, the conclusion was reached that for the first demonstration it would be well not to make any changes that would prevent the burden being reduced completely by one passage of the furnace gas. We can, however, decrease the shaft requirements to the extent of charging calcined limestone, which will, of course, increase the limit to which we may go regarding the reducing power of the gas. We can also eliminate hot-blast stoves, supplying wind at atmosphere temperature.

Results To Be Effected

After carefully considering the matter, it was concluded that in this particular practice, 31 per cent of the oxygen in the blast will be as high as it will be practical to go, and that this mixture, when charged to the furnace cold, will increase the production of the furnace by 18.0 per cent and decrease costs 6.7 per cent.

On the whole, the study of this problem has firmly convinced the committee that with the application of oxygen to the present blast-furnace we will accomplish the following results:

1. Decrease of production costs:
   a. By increasing the high temperature or smelting heat available per unit of fuel.
   b. By removing the necessity for charging more coke than is theoretically necessary.
   c. By rendering hot blast unnecessary, and reducing the initial investment by the cost of hot-blast stoves, at the same time releasing for other use the gas consumed for this purpose.
2. Increase in the present output per furnace.
3. Increase in flexibility of the process, by giving the operator a remedy for any irregularity or trouble occurring in the hearth and bosh section.
4. Increase in uniformity of product, by admitting of much closer chemical control.
5. A change in the limiting factor of the process from the inaccessible hearth and bosh section to the shaft section. This will mean that in the new process, any economy accomplished in the shaft section will be effective in increasing production and efficiency.
6. Make possible the use of cheaper materials, ore of a lower iron content, and coke higher in ash.
7. In addition to the above, it is believed that the sulphur content of the iron would be reduced by this practice.

There are available what might be termed intermediate ores, which, while they do not contain sufficient phosphorus to make the basic bessemer process

possible, still the amount of this element is too high for use in the acid converter. If, however, the heat requirements for the process might be lowered below those of standard basic practice to correspond with the lower phosphorus in the pig iron available, we would have a process which would utilize these rather unsatisfactory products to our advantage, securing a steel better in quality than that obtained by the acid bessemer process, and as a byproduct a high-phosphorus slag valuable for fertilizer.

Calculations show that it is possible to obtain the same thermal results on a 1 per cent phosphorus iron with a 38 per cent oxygen blast as are obtained when blowing a high phosphorus both with atmospheric air. It is asserted that this steel will be of almost as good quality as average open-hearth steel.

In order to obtain some rough idea of cost comparison, the present low-carbon open-hearth steel requires as fuel 600 lb. of gas coal per ton, which at present costs $7.50 per net ton delivered, or a fuel cost of $2.25 per ton of steel. With the proposed basic bessemer process along the lines shown in the heat balance we would require 0.0448 ton of oxygen per ton of steel, or with oxygen available at $3 per ton, a cost of 13.44 cents for oxygen per ton of steel.

While the open-hearth process represents the greatest development in quantity steel production at the present time, it is a process in which the thermal efficiency is very low. Accordingly, although oxygen will effect economies it is felt that the more obvious defects should first receive attention.

Clements (*Transactions*, British Iron & Steel Institute, May, 1922) has given the heat losses of open-hearth furnaces. The longest and most striking figure is that of heat lost by radiation from bath and port ends—44.20 per cent of total heat loss. This figure impresses us as a most forceful argument as to the truth of a conviction we have had for a long time, that is, that the open-hearth process stands in vital need of a new and what we might term a "super-refractory." The silica brick used for the roof and port ends of the furnace is the purest obtainable, and while it is the most suitable material available, it is in our estimation far from being an ideal refractory for even the present requirements. The brick as used today has a fair life as a refractory, but is in no sense of the word, a heat insulator nor is the endurance of this material in the service to which it is subjected, great enough to allow us to supplement it by a heat insulator. What the industry needs is a brick so resistant to heat and metallic fumes, and one of such thermal expansion, that it will not only serve as the silica brick does today—as an uncovered arch and wall—but will stand the still more severe test of being covered with a heat-insulating material to prevent, in a large measure, the too great heat loss through these sections. As to the possibility of obtaining such a material, we see no reason to say it can not be done. Price should be of secondary consideration, for such a material once introduced, would not only add materially to the life of the furnace, but would save millions of dollars in fuel cost.

There is more than a small element of the dramatic in the paragraph headings on these two papers. Read them over—

Problems in Applying Oxygen to Open Hearth Practice—Oxygen in the Manufacture of Artificial Gas—Oxygen in the Manufacture of Ferro-Alloys.

And in reading them remember that these are not headlines in a sensational journal but paragraph headings in a technical report by a group of experienced men. It is a report that presages great economic development. What changes will eventually follow obviously cannot be foretold. It is entirely possible, however, that metallurgical practice is about to enter upon a new era.

In the matter of applying oxygen to metallurgical processes, our first thought is that of increasing temperatures. As our present refractories are now subjected to their maximum working temperatures, we will not consider the matter in that connection at present, but more with the idea of retaining a greater percentage of the total heat for a useful work than is the present practice. Clements gives the loss of heat by radiation for the regenerators as 15.50 per cent of the heat lost, and that from the chimney gases as 36.2 per cent of the heat lost. The chief function of the regenerating system in our present hearth process is that of increasing the temperature of combustion by adding sensible heat to the gases before they are burned. With oxygen available we will have another method of increasing the flame temperature, which, instead of heating the gases, will simply decrease the amount of inert gases entering the furnace and diluting the calorific intensity of the reaction. Suppose that we go even further than the regenerators, and start by replacing with pure oxygen the air now used in operating the gas producers, increasing at the same time the steam used in order to dampen the higher producer temperature otherwise obtained. We will now secure a fuel gas of greater calorific power which may be burned from one end of the furnace only, using a mixture of oxygen and air, the oxygen content of which may be regulated as our temperature requirements dictate. From the exhaust end of the furnace, instead of passing through regenerators with their accompanying expense and heat loss, let us carry the reduced volume of gas through a waste-heat boiler, lower its temperature to 300 deg. C. and utilize the heat above this temperature in the generation of steam.

With a process of this nature we will not only eliminate the checker-work, but will take a big stride in the way of efficient combustion and proper direction of the flame. In our present furnace, any mixing of air and fuel gas must be done in a crude manner, in that the only burner possible, in order to withstand the action of the intensely hot gases and flame during half of the operation, must be of a highly refractory material, and even this is always losing efficiency as a gas mixer due to its "slagging" away. If it were not necessary to reverse the flow of gases to the furnace it would become possible to construct an efficient burner which would not only effect a perfect mixture of the gases, but which might be used effectively to direct the flow of gas in any manner desired. It is just possible that, with a device of this kind, we would be able to direct the flame to follow the bath more closely than is possible today, and relieve the roof to some extent of its high-temperature condition.

Studies along these lines have convinced the committee of the following:

1. While the application of oxygen for combustion in the open hearth will effect some saving in fuel energy, with our present refractories the saving will be in the form of a byproduct and not of practical value. However, if we can prepare refractories which will withstand much higher temperatures, the application of oxygen to the process will be of great value, both in saving fuel and increasing materially the speed of the process.

2. That the application of oxygen for combustion with an idea of substituting cheaper fuel for the very expensive fuel used today is a field of particular promise.

3. Taken from the standpoint of quality of product, the substitution of oxygen for air in the last part of the process will enable us to make in the open hearth steel of electric furnace quality.

4. That the substitution of oxygen for the iron ore now used as an oxidizing agent will not only give a higher grade product, but it will decrease the time required for the process by about 3 hours.

Application of Oxygen to the Manufacture of Artificial Gas

While the manufacture of city gas was beyond the scope of this investigation as originally outlined, there are certain possibilities in that line which we will state briefly.

Water-gas made with atmospheric air is largely used for city purposes, but in order to meet the accepted standards of heating value and illumination, which vary in different cities, it is necessary to "doctor" the gas by the addition of hydrocarbon oils.

Water-gas made with atmospheric air has a heating value less than 300 B.t.u. per cu.ft., but gas made in the same manner, substituting oxygen for air would have a heating value of about 400 B.t.u. per cu.ft. Such gas would require less additions of oil to bring it up to heating value standards of 500 to 600 B.t.u. now required, and this smaller quantity of added oil would probably be sufficient to meet the illumination standards.

With a 400 B.t.u. gas available it would be much easier to induce municipalities to eliminate the obsolete illumination standards than have been found possible heretofore with straight water gas, particularly as this moderate heating value gas could be produced at a very attractive figure.

With this in view, a comparison was made between the process of making water-gas today and a proposed process using oxygen and steam in the regular gas producer. This is summarized in the following rough comparison of costs, using coal at $7 per 2,000 lb. delivered, coke at $11 per 2,000 lb. delivered, and oxygen at $3 per 2,240 lb.:

COMPARISON OF COSTS PER 1,000 CU.FT. OF GAS

	Coal		Oxygen		Total Material Cost	B.t.u. per Cu.Ft.	Cost per 1,000 B.t.u.
	Lb.	Cost	Lb.	Cost			
Straight producer	19.391	0.0678			$0.0678	221	$0.000307
Water gas	37.114	0.2041			0.2041	283	0.000712
Oxygen process	33.12	0.1159	6.7	0.009	0.1249	400	0.000312

From a straight city gas standpoint, the gas made with oxygen will not only be of greater calorific value than water-gas, thus requiring less enrichment, but will cost less. It is our opinion that a gas of 400 B.t.u. could be used for this purpose without any further enrichment and the saving in this case would be much greater.

On comparing with the producer gas we find that the cost per cubic foot of "oxygen made" gas is greater; but inasmuch as the heating value of the new gas per cubic foot is nearly doubled, the value as a fuel will be even greater than twice that of producer gas. It was really from a fuel standpoint that the question of gas was first considered, and this study is submitted more to show the progress which may be expected along lines using very low-grade fuels in producers to make a fuel gas. We can not predict by calculations just how far we could go in this field, or what fuels we would be enabled to use for making gas; but we feel that experimental work should be started as soon as possible along this line.

Application of Oxygen in the Manufacture of Ferro-Alloys

The field of ferro-alloys is one of particular promise in the application of oxygen to combustion. So far, only a few of the ferro-alloys respond to blast-furnace reduction because of the inability to supply the high temperature heat required in this type of furnace. For this reason, electric-furnace processes have been necessary for the industrial production of all but three of the common alloys, and as is true with all electric-furnace processes, the cost of production is very high. Ferromanganese, ferrochrome, and low-grade ferrosilicon can be manufactured in the blast-furnace, but only with a very high fuel consumption. Inasmuch as ferromanganese is one of the most common alloys made in the blast furnace, study was made of this process as it exists, and further investigations as to the results to be expected with the application of a blast enriched with oxygen.

The table above gives a comparison of the costs based on present operation with proposed operation using oxygen at $3.00 per ton.

COMPARISON OF MAKING FERROMANGANESE WITH AIR AND OXYGENATED AIR

Blast used	Air			26.3% O_2 Blast		
	Per Ton FeMn Lb.	Cost Per Ton Material	Cost Per Ton FeMn	Per Ton FeMn Lb.	Cost Per Ton Material	Cost Per Ton FeMn
Manganese ore	6,169	$18.00	$49.572	6,165	$16.70	45.962
Coke	6,707	10.00	33.535	3,829	10.00	19.145
Limestone	2,548	1.25	1.421	1,259	4.00 (calcined)	2.249
Labor:						
Supt., fireman, etc.			.142			.081
Stocking			.029			.029
Charging			.317			.317
Casting			.758			.432
Other producing labor			.027			.015
Repairs and supplies			1.378			.785
Steam			.012			.007
Blowing			1.169			.475
Water			.269			.154
Hydraulic and pneumatic power			.027			.015
Electric light and power			.046			.026
Yard switching			.291			.291
Handling material (raw)			.593			.593
Chemical laboratory			.069			.069
General works			.132			.075
Safety welfare			.019			.011
Contingent fund			.030			.017
Relining fund			3.000			1.714
Oxygen				203	3.00	.272
Gross total cost			92.836			72.734
Credit for surplus gas 345,000 cu.ft. @ $0.032 per 1,000			11.04	164,000 cu.ft. @ $0.38 per 1,000		6.23
			81.796			66.504
				Saving per ton		15.292
						18.7%
Daily production 60 tons ferromanganese.				105.5 tons ferromanganese 75.8 per cent increase		

What Are the Chances for

Cheap Industrial Oxygen?

A Careful Survey of Existing Processes and Excellent Experimental Investigation by an English Investigator Give a Negative Answer to the Query "Can We Produce Oxygen at 1s. per 1000 Cubic Feet and at Low Capital Cost

DURING THE SPRING of 1921 the directors of the Woodall-Duckham Vertical Retort and Oven Construction Company (1920), Ltd., decided to institute an investigation with the possibilities of cheap oxygen—a subject of fundamental importance to the gas industry (and, it should be noted, to the metallurgical industries as well). The report of this investigation, prepared by T. Campbell Finlayson, of the development section of the company referred to, and published by the Institution of Chemical Engineers, constitutes the first contribution to technical literature which deals solely with oxygen. The 82-page monograph contains a critical review of past and present processes for the production of oxygen as well as a vast amount of experimental data covering attempts to improve some of the existing methods or develop better ones. While it is impossible to do justice to the report in abstract, the following paragraphs will indicate the field covered.

After a careful study of existing processes for preparing oxygen and experimental work designed to improve those which seemed most promising, an English investigator concludes that at the present time there is no simple process which will produce oxygen at a price not exceeding 1s. per 1,000 cu.ft. at a low capital cost.

The object of the research was to investigate the possibilities of obtaining large supplies of cheap oxygen at a price not exceeding 1s. per 1,000 cu.ft. by some process which must be simple to run, and not requiring excessive capital expenditure. The immediate use of the oxygen was for gasification purposes, and we may take as an example of the size of plant required, that for a works making 1,000,000 cu.ft. gas per day would necessitate an oxygen plant with a capacity of 170,000 cu.ft. per day. The object of gasification with oxygen is to obtain an increase in the thermal efficiency of the process and thus lead to cheaper gas. It is therefore obvious that the oxygen process which is to be used for such purposes must produce oxygen simply and cheaply.

A study of the extensive literature on oxygen manufacture has shown that there is no method which has been described that promises to give results better than those obtainable today by the best methods of liquefaction.

Chemical Processes Fail Through Thermal Inefficiency

The majority of the processes that have been worked out are chemical processes. Without exception all these processes had to be carried out at comparatively high temperatures, and it is largely the thermal inefficiency which has killed these processes.

An examination of the chemical processes which have been described does not hold out much hope of their meeting the requirements.

The Brin process, depending upon the formation and decomposition of barium dioxide, is probably the most successful of the chemical processes. But even this process has to be carried out at 700 deg. C., the air from which the oxygen is to be obtained has to be carefully purified and the reacting mass revivified from time to time. According to the figures of those who have had experience on this type of plant one could not possibly obtain oxygen at 1s. per 1,000 cu.ft.

Other chemical processes have been suggested. Many of these, such as the Tessie du Motay and the Plumboxan processes, demand elaborate and complicated chemical reacting masses. Such processes are open to the objection that the reacting masses may lose their activity, and one cannot see the possibility of large plants making cheap oxygen by these processes.

If a chemical process is to be used one must find a substance which requires a low reaction temperature. Two possibilities seem to present themselves.

1. The interaction between nitrogen oxide and oxygen from air to form nitrogen peroxide. This action goes on with great speed at ordinary room temperature, and if a method of isolating the oxygen could be devised when the action was reversed a very simple process would result. Up to the present time no method of reversing the action without the intervention of some other working mass which involves heat treatment has been found. In addition to this fact small losses of oxides of nitrogen would soon render the process useless.

The second reaction is the formation and decomposition of oxyhæmoglobin. A careful study of the chemistry of this compound has been made. Hæmoglobin has the power of combining with oxygen from the air at room temperatures to form a definite compound, which compound can be dissociated by a change of pressure with the liberation of oxygen.

Both from a thermal and a power point of view this looks a very hopeful line. But unfortunately hæmoglobin, which is the active constituent of the blood of mammals, is a complicated substance and has certain great disadvantages.

1. *Difficulty of preparation.*—It is necessary to obtain animal blood, centrifuge the serum away, wash, freeze, and lake the corpuscles.

*Abstracted from "Industrial Oxygen—An investigation into the possibilities of obtaining cheap oxygen," by T. Campbell Finlayson, Transactions of the Institution of Chemical Engineers, June, 1923.

2. *Difficulty of keeping the solution.*—Bacteria are very active in a solution of hæmoglobin, and the solution would tend to putrefy. The putrefaction might be overcome by the addition of certain sterilizing agents, but it is possible that these would alter the absortive power of the hæmoglobin.

3. *Difficulty of coagulation.*—The hæmoglobin solution would set solid if heated too high.

4. *Frothing.*—Reduction of pressure, for the removal of the oxygen, is accompanied by considerable frothing.

One therefore feels that although a process based on the use of hæmoglobin is by no means impossible, yet a very considerable amount of work would be involved in the establishment of such a process, and one cannot imagine very large plants working on this process. It is therefore felt that for the present purposes the hæmoglobin process is not sufficiently attractive.

The conclusion one is driven to is that a physical method of separation should give us the advantage of being able to finish up with a gas containing something less than 100 per cent at a cheaper rate than pure oxygen. In chemical processes it is often most favorable to work for as pure a body as possible.

Physical processes have received a certain amount of treatment by previous inestigators.

The physical processes come under four headings:

1. Liquefaction processes.
2. Adsorption processes.
3. Diffusion processes.
4. Solution processes.

Liquefaction processes.—The subject of obtaining oxygen by the liquefaction and subsequent distillation of air has received full and careful treatment. The bulk of the production of oxygen from air is at present made by the liquefaction process. The costs of this process are well known, and any development in this line seems bound to come from those who are utilizing the process. Although the process has been working for nearly twenty years, it has not yet really produced what may be called cheap oxygen.

K. S. Murray, in November, 1922, gave the probable lower limits of power consumption for oxygen production by the liquefaction process as being 30 b.h.p. per 1,000 cu.ft. oxygen, and gives the cost of production of oxygen by a large plant as being about 4s.6d. per 1,000 cu.ft.

Adsorption processes.—The adsorption of gases by some solids is a very remarkable phenomenon which would enable a separation to be effected by a process of fractional heating of the solid. There are, however, great difficulties in the way of this process. The use of charcoal, the cheapest adsorbent, is almost out of the question, because of the conversion of the oxygen into carbon dioxide. The use of other adsorbents, such as silica gels and alumina, have been examined briefly in the present research.

A process using adsorption has certain advantages:

1. It is rapid.
2. It requires no elevated temperature and no high pressure. On the other hand, the adsorbing substances such as charcoal, silica gels, etc., are difficult to prepare in an active form, and their activity is easily destroyed.

On examination of the published literature it was soon found that the whole subject of the adsorption of gases by solids is in a somewhat confused state.

A suitable adsorbent for separating oxygen from the air must possess certain characteristics:

1. It must adsorb as much oxygen as possible.
2. It must have the power of selectively adsorbing oxygen from the air.
3. It must give up its oxygen without being destroyed.

Charcoal naturally comes to mind as an adsorbent. At room temperature charcoal adsorbs five or six times its volume of gas containing over 50 per cent oxygen. But with charcoal the difficulty is that only a portion of the gas is given off as oxygen, part being burnt to carbon dioxide.

Two further adsorbents were therefore prepared. Alumina fiber, a substance in use in Germany under the name of "Gewachsene tonerde." It is well known that alumina has the power of adsorbing gases, and it was therefore thought that this substance which was really a more open form of alumina would have these adsorbent properties to a greater extent. This was found to be the case. Under similar conditions the alumina fiber was found to have about six times as great an adsorptive power as charcoal. It is, however, very fragile, and somewhat difficult to make and handle, and one cannot see herein the basis of a large scale process. The same difficulty of preparation and handling applies to the use of silica gel, made by Briggs' scheme.

Diffusion.—There are two types of diffusion which result in separation.

(a) Diffusion through porous bodies. This is an exceedingly slow and laborious method depending upon the square root of the densities of the gases. As the densities of nitrogen and oxygen are as 14:16 the separation is almost impossible.

(b) Diffusion through thin films of liquid. This is in certain cases rapid, and results in a separation depending upon the differential solubilities, which is generally more favorable than the differences in densities. Helouis endeavored to use this phenomenon of diffusion in his process, using thin rubber sheets. These processes do not seem likely to solve the present problem.

Solubility.—Gases have different solubilities and a process was suggested and tried some years ago for separating oxygen and nitrogen by this means. The original process, which involved compressing air in contact with water—allowing the gas dissolved to escape and re-compressing it a number of times—is useless as a method of procedure. It is too costly in power and plant.

It seemed possible to introduce considerable sim-

Pressure Fractionation

This Was a New Idea to the Staff

Ordinary fractionation is, of course, a temperature fractionation, but on this page there is an account of a separation by means of pressure differences.

The first interesting fact about it is that it was an experimental confirmation of an idea based on theoretical considerations. The next is that it has commercial possibilities that are stimulating. As yet it is hardly more than an interesting experiment and it may never be capable of producing oxygen for 1s. per 1000 cu.ft. or less but the principle should be watched with interest for it is likely to have many other applications in industry.

plification, and a process which has been named "pressure fractionation" was proposed, by J. Stanley Morgan. This process bears the same relation to the above discontinuous process as intermittent fractional distillation does to the use of a fractionating column.

For any solution process the only valuable property a solvent possesses is a differential selection, and the greater this is the less power will be required. If the oxygen and nitrogen were soluble in exactly the same proportions no change would be produced and infinite power would be required. If one gas were completely insoluble we should obtain the other pure in solution. Therefore, unless questions of cost of solvent or size of plant are factors, we ought always to select the liquid which shows the greatest difference in solubility.

Now suppose we take sufficient liquid to dissolve all the oxygen we require, and suppose we select water which shows a preference for oxygen in the ratio of 2:1. Let us consider the dissolved gas and not the gas which comes off. The pressure we will suppose is 10 atmospheres, for convenience. We have liquid saturated at this pressure with air and thus in equilibrium with 21 per cent oxygen.

If we place the liquid in a cylinder fitted with a piston and raise the piston through a very small distance dx some gas is given off. This gas will be in equilibrium with the solution. But we have just seen that the solution is in equilibrium with air. In other words, if we allow a small quantity of gas to be given off it will be substantially air. The result of this is that the oxygen content of the gas in solution rises. The law governing the nature of the gas given off is that each constituent is proportional to the concentration in the liquid and inversely as the solubility coefficient. That is, the more easily soluble a gas is the more it tends to stay in solution, but the more concentrated the solution becomes the more it tends to leave. This simple law is almost exact, and it is possible to find exactly the gas which would be given off and left behind at any point.

The Pressure Fractionation Process—A Remarkable Development

Based upon this reasoning, without experimental confirmation, Morgan suggested the pressure fractionation process.

A very complete experimental investigation has shown that the process, which was arrived at from purely theoretical considerations, holds in practice almost exactly, and it is thought that this process is a definite advance on any previous solution process.

The experimental work has shown how very marked is the influence of agitation on the rates of solution, evolution and attainment of equilibrium between solvent and gas. It has been demonstrated that with certain oils these rates are so rapid that the times involved are measured by seconds.

Based upon this fractionation process, a supply of 30 to 40 per cent oxygen gas could probably be obtained at a reasonable price, working upon the data already obtained.

The scheme for the fractionation process would be something as follows: The plant consists of two vessels, each fitted with efficient stirrers and a gas offtake at the top. Each vessel is full of suitable oil; the agitators are running. Air is pumped into No. 1 vessel until the pressure is 135 lb. per sq.in. Further gas (blow back gas) is pumped into No. 1 until the pressure is 150 lb. per sq.in. We thus have No. 1 saturated at 150 lb. with a gas containing about 22 per cent oxygen ready for the fractionation. The fractionation is carried out as follows, equilibrium being regarded as existing throughout. The pressure is allowed to fall to 75 lb. The gas evolved is passed through the high-pressure blower for the recovery of as much power as possible, and is then blown to waste.

The pressure is then allowed to fall to 36 lb. through the low-pressure blower also for power recovery. This second portion is also valueless. The pressure is then allowed to fall to 20 lb. This gas contains about 25 per cent oxygen and is compressed and pumped into No. 2 vessel during the solution stage, this being the blow back gas. The pressure is allowed then to fall to 1 lb. absolute, the gas evolved being of the mean composition of 40 per cent oxygen. Means will have to be provided for the rapid evacuation of the oil down to this low pressure.

The main cost of the process lies in the compression of air. Efficient means will have to be provided for the recovery of the power from the compressed air. A study of the economics of the process has shown that it is the cheapest to dissolve all the air compressed, and thus start the fractionation with 21 per cent in solution. This start is the factor which determines the higher limit for the final oxygen strength. Thus, if we could start with 30 per cent oxygen in solution, we should obtain a final oxygen of 60 to 70 per cent strength.

Various means of obtaining a large supply of cheap 30 per cent oxygen have been examined. A scheme which we have called film filtration, depending upon filmed surfaces, with interior low pressures, has been investigated but has not proved successful.

A further scheme for improving the pressure fractionation effect in order to give strong oxygen gas at an economic figure has been considered. This depends upon the use of methyl or ethyl alcohols at low temperatures as solvent. According to some work it appears that the solubility of oxygen increases with fall in temperature, while the solubility of nitrogen decreases. In this way the differential solubility becomes greater, leading to a sharper fractionation. As far as our experiments go, it has been found that there is practically no advantage in carrying out the fractionation at low temperatures. Moreover alcohol is more expensive than oil, is more volatile and fractionates less efficiently. This line of improvement by using alcohols has thus been abandoned.

General Conclusion

As the result of this work the conclusion is reached that up to now no process has been devised which will satisfy the conditions laid down, namely, a simple process which would produce oxygen at a price not exceeding 1s. per 1,000 cu.ft. at a low capital cost.

It is felt, however, that the pressure fractionation process has many sound features, although it has not achieved the success hoped for. It appears that a supply of 40 per cent oxygen could probably be made by this process more cheaply than by any existing means, but that the process becomes much less efficient when one attempts to produce oxygen of 60 to 70 per cent strength.

It is considered that for gas-making purposes the installation of an oxygen plant on the above lines to make 30 to 40 per cent oxygen would not be an economic proposition.

"Aluminum Hydroxide Solution"

A New Coagulating Agent, Suitable for Water Clarification, Composed of Alum and Soda

By Joseph W. Coxe, Jr.
Viscose Corporation of Va., Roanoke, Va.

Quite contrary to expectation, if a strong solution of aluminum sulphate is mixed with a strong solution of soda ash, the reaction product is a clear solution, which gives promise of being very useful in water clarification work. For example, dissolve 40 g. of $Al_2(SO_4)_3.18H_2O$ in 80 c.c. of water and 10 g. of soda ash in, say, 40 c.c. of water. Then pour the soda solution into the solution of aluminum sulphate, and stir. The mixture will effervesce, and, at first, a thick precipitate of $Al(OH)_3$ will form; but this will dissolve almost immediately, and in a few minutes, with stirring, a clear solution will be obtained. For the sake of convenience the solution is referred to in this article as "aluminum hydroxide solution."

This solution possesses some interesting and useful properties. If aluminum sulphate and soda ash are used in the stated proportions, the solution will keep for days without changing, and, on dilution, even with distilled water, precipitation and coagulation will occur immediately.

Unless the proportions of the two substances are kept in mind, the first thought that occurs is that the solution is simply sodium aluminate. But on consideration, it is seen that this cannot be, as the amount of soda ash used is only about half of the amount required to bring about the regular reaction of soda ash with aluminum sulphate:

$$\underset{667}{Al_2(SO_4)_3.18H_2O} + \underset{318}{3Na_2CO_3} = 2Al(OH)_3 + 3Na_2SO_4 + 3CO_2 + 15H_2O.$$

By using sodium hydroxide or bicarbonate, a similar solution is obtained. Sodium hydroxide requires alonger time for solution, however, while the bicarbonate effervesces excessively. The proportions, of course, are varied to equalize the difference in molecular weights.

What Are the Advantages of This Solution?

Aluminum hydroxide solution can apparently be used with the same effect as aluminum sulphate in water clarification, and in addition, seems to offer several decided advantages which will be considered briefly.

1. Under conditions usually met, the condition of the water to be treated will make little difference. The water may be either of zero softness or very hard, as no conditioning is required to bring about precipitation and coagulation, unless, of course, the water supply contains considerable free mineral acid.

This fact will often permit the coagulant to be independent of the water softness, and in cases where it is only desired to clarify, and not to soften, or where it is desirable to clarify a very soft water, without the use of an alkali to produce precipitation, as would be necessary where aluminum sulphate is used, dilution is all that is necessary.

2. If lime is used to soften and coagulate, or if calcium bicarbonate is present, then obviously the use of aluminum hydroxide solution will yield a water with less permanent hardness than if the lime were allowed to produce the precipitate by reacting with the aluminum sulphate. Sodium sulphate is formed, instead of calcium sulphate, in this case.

Clears Solution of CO_2

3. Where free CO_2 in the water is undesirable, it is also obvious that the aluminum hydroxide solution is more advantageous. Since the reaction for the decomposition of aluminum sulphate nearly always liberates CO_2, clearly the usual method increases the amount already present. By the use of this solution, it is seen that the liberation of CO_2 occurs before the solution is added to the water.

4. The clearest advantage, however, lies in the very short time required for coagulation. Where, in usual practice, the precipitation and coagulation of $Al(OH)_3$ is a matter of several hours, aluminum hydroxide solution requires only a few minutes. This would make it desirable for those plants which must worry along with small settling basins.

Many plants treat the water as it enters the basin. When very high turbidity prevails, the heavier sediment carries down all the alumina at once, leaving the fine suspended matter to travel through the filters which effect a thorough removal.

To use more aluminum sulphate further on in the basin, or in the filters, might result in some of it passing the filters, but the aluminum hydroxide solution could be added, even as the water enters the filters, with immediate coagulation.

Mixing Chemicals Before Dissolving

This solution can, of course, be made by grinding the alum and soda ash together to a fine powder, and simply making up as one solution, provided it is made sufficiently concentrated. This would possess few advantages, however, and would add considerable trouble and expense. Furthermore, such a mixture does not seem to keep exceptionally well. A method which is used with success in special work is to add the ground mixture continuously to the solution to be clarified. Any sort of constant rate mechanical feeding device may be employed.

Such a mixture is, in fact, at present on the market. The price is very high, however, and this may be due to the cost of intimately grinding and mixing the constituents.

Naturally, the producers could not put out this product in separate containers, as they wish to keep the mixture secret, and by putting it out in the mixed form, which decomposes when moistened, they have a rather tricky composition to analyze.

The writer is not in a position to state just how widely the ratio of 4 parts of $Al_2(SO_4)_3.18H_2O$ to 1 part of Na_2CO_3 can be varied. Of course the ratio of aluminum sulphate could be raised, but it is not known how this would affect coagulation. On the other hand, if too much Na_2CO_3 were added, a solution could be obtained, but just when this limit is reached has not been investigated. Undoubtedly much work could be done to advantage in perfecting this coagulant. It is the desire of the writer simply to bring its possibilities to the attention of his contemporaries in order that the method may be further developed.

Also, to the knowledge of the writer, the same amount of aluminum sulphate is used in this way as would be used to clarify a certain water in the regular way. It might be considered only a preliminary treatment of the aluminum sulphate.

Eliminating Defects By

Putting the X-Ray to Work In Everyday Production of Metals

A Method of Testing Metal Products That Does Not Destroy—Simplifies Control of Standard Quality—Adapted to Needs of Maker and User*

BY ANCEL ST. JOHN.
Union Carbide and Carbon Research Laboratories Inc.,
Long Island City, N. Y.

X-RAY examination permits non-destructive tests of metals. Hitherto it has for the most part been restricted to objects of nearly uniform thickness and regular outline. Inspection of such miscellaneous articles as those shown in Fig. 1 has been, to say the least, inconvenient and unsatisfactory. This figure represents a group of ⅜ in. hexagonal-head machine bolts, a piece of iron pipe, a brass lens-holder from an optical bench, a ⅜ in. hexagonal-head machine bolt, two ¼ in. rough sections of 1 in. bar stock, a brass thumb screw, a piece of ¼ in. x ½ in. brass bar, five pieces of cobalt and half of a ½ in. cold-headed machine bolt which has been cut in two lengthwise.

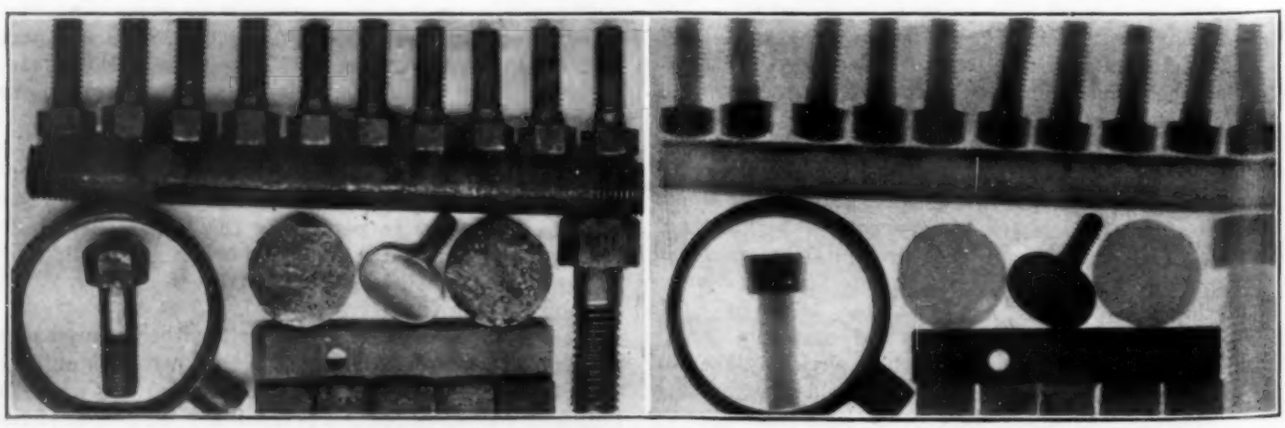
Defects in the interior of metal objects are troublesome to both manufacturer and user. For the former they are frequently the cause of increase in manufacturing cost through the rejection of material when defects appear after considerable work has been done. For the latter they are too often the cause of damage to equipment, personal injury and even loss of life when a part, which has passed all inspections and been put in service, finally gives way because of a hidden flaw. Methods of testing which locate such flaws without subjecting the specimen to possible, if not actual, destruction are few and far between. X-ray examination, whether fluoroscopic or radiographic is such a method.

Satisfactory examination requires that the transparency to X-rays of all parts of the region exposed at one time shall be of the same order of magnitude. Otherwise the portions of the fluorescent screen or photographic negative corresponding to the most transparent parts will be materially over-illuminated when the illumination for the least transparent parts is correct. Essential details will consequently be obscured. This is shown in Fig. 2 which is a radiograph of the group of objects of Fig. 1 exposed so as to bring out the defect in the head of the ½ in. bolt and some cracks in the cobalt.

To overcome this difficulty the writer has developed a method of mounting specimens which makes possible the examination of such objects. The results with this method are shown by Figs. 3 and 4 which are radiographs of the same group of objects by the new technique, exposed so as to bring out the defects referred to. Not only are the outlines of the objects clearly defined but many structural details not apparent in Fig. 2 are easily discerned.

In this new method the specimens are surrounded with a medium of slightly different transparency to X-rays in a container with opaque walls and parallel transparent faces as shown diagrammatically in Fig. 5. In this way the transparency of the entire field is made of the same order of magnitude. If the absorptive power of the surrounding medium is less than that of the specimen, its transparency will be greater and more X-rays will pass through it than through the specimen which will thus appear as

*A paper to be presented before the American Institute of Mining and Metallurgical Engineers at Montreal, August 30, 1923, and preprinted through the courtesy of the Society.



FIGS. 1 AND 3—A GROUP OF METAL OBJECTS—PHOTOGRAPH ON LEFT (FIG. 1) MADE IN ORDINARY MANNER. PHOTOGRAPH ON RIGHT (FIG. 3) MADE BY NEW PROCESS RADIOGRAPHY

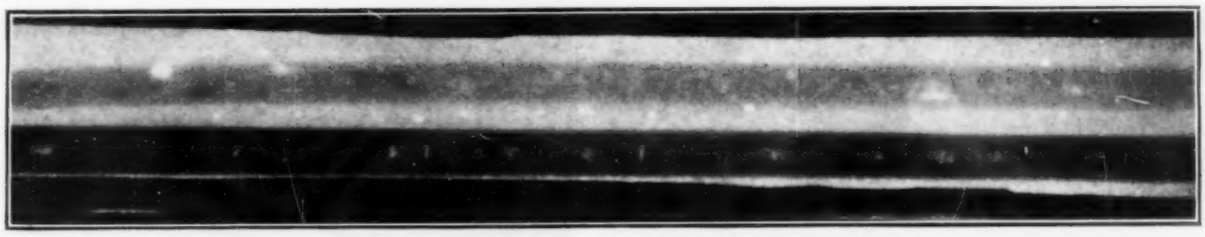


FIG. 7. RADIOGRAPH MADE WITH GRANULAR ABSORBER

a darker area as shown in Fig. 3. But if the absorbing power of the medium is greater than that of the specimen less X-rays will pass through it than through the specimen which will then appear as a lighter area as in Fig. 4. In this latter figure the absorber used for Fig. 3 has been replaced by a more opaque medium with a transparency less than iron or cobalt but greater than brass. The change in the radiograph is striking.

In general it is preferable to have the medium less absorbent than the specimen as the time required for a satisfactory exposure increases rapidly with the absorption. But there are cases where the more absorbent medium is useful. For instance it is thus possible to distinguish indentations on the surface from cavities in the interior. The former being filled with absorber would be darker, the latter being empty would be lighter.

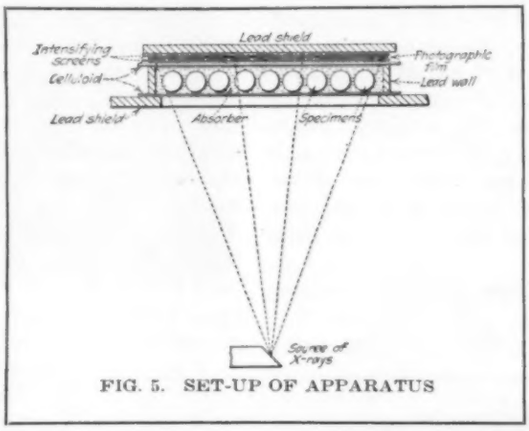


FIG. 5. SET-UP OF APPARATUS

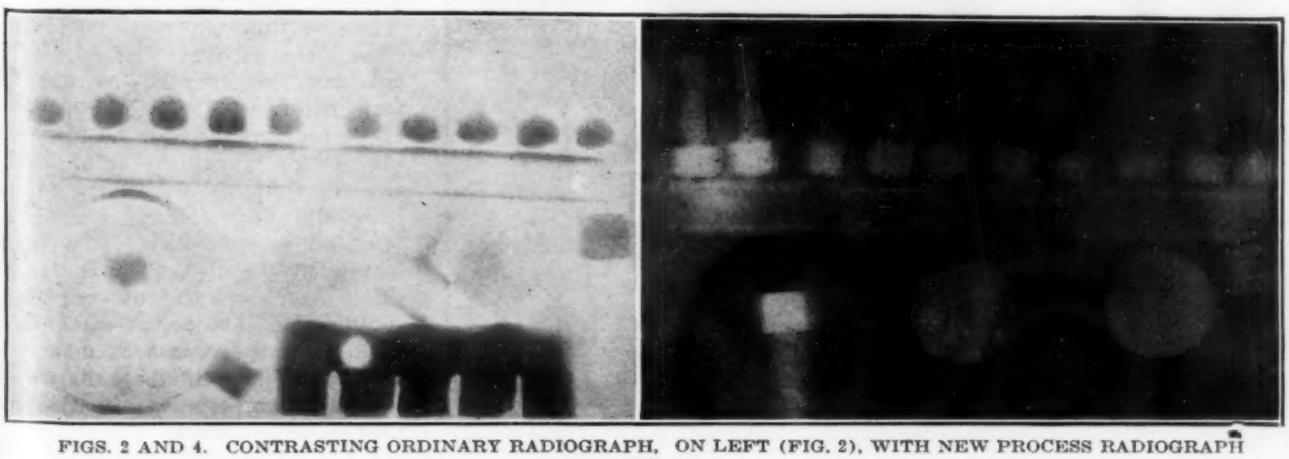
Difficulties with Granular Absorbers

Before investigating the suitability of various materials as absorbers for use with tool metals a series of bars of tool stock was examined and a few containing interesting defects were selected as tests specimens. Many absorbers were then studied. Granular substances give much the same appearance as a spongy structure in the specimen and are useless. Fine powders are better in this respect, but it is next to impossible to pack them uniformly when dry, and when mixed with water, oil or grease to form a paste, they tend to occlude air, forming cavities indistinguishable from blowholes in the specimen. This is shown in Fig. 7, representing two specimen bars in a paste of white lead and water. The best substance is a liquid.

The choice of liquids is restricted to compounds of high density, containing a constituent of high atomic weight so that the X-ray absorption may be high. Convenience further demands that the liquid should not react appreciably with the materials to be examined, should mix in all proportions with a common liquid and should be non-volatile. Of the numerous liquids tested methylene iodide, CH_2I_2, has proved most satisfactory. Its density is 3.34 grams per cubic centimeter; its principal constituent, iodine, has a very high X-ray absorption, so that it can be used with alloys containing as much as 25 per cent of tungsten; it mixes in all proportions with benzene, so that dilutions suitable for use with less absorbent alloys can be made; it is less volatile than water; and it reacts but slightly with most metals. Its objectionable features are a characteristic and persistent odor, a tendency to react with aluminum and a rather high price.

The actual cost in service can be kept low by rinsing specimens and containers in benzene after exposure, saving the rinsings and using them to replace benzene lost by evaporation from the dilute solutions. In this way one lot has been used day after day for nearly six months with a wastage of about 10 per cent. The reaction with aluminum is a decomposition accompanied by the evolution of heat and the liberation of iodine vapor. It takes place suddenly after the metal and liquid have been in contact for some time and is apparently encouraged by the presence of other metals in contact with the aluminum, by heating, and possibly by exposure to X-rays. It can be avoided by rinsing specimens and vessels at once after making an exposure.

When methylene iodide was first used the specimens were immersed in the liquid container in an aluminum



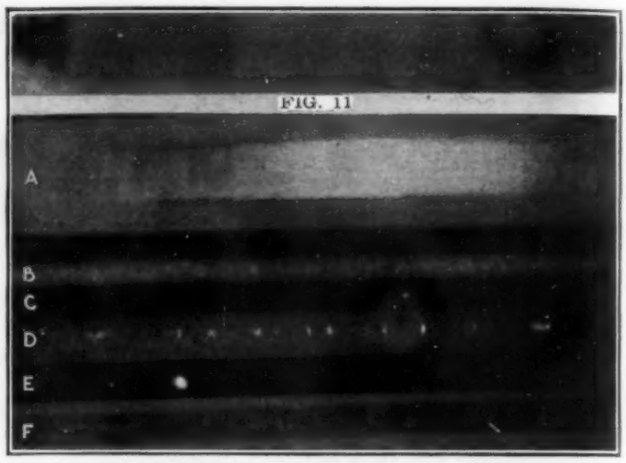
FIGS. 2 AND 4. CONTRASTING ORDINARY RADIOGRAPH, ON LEFT (FIG. 2), WITH NEW PROCESS RADIOGRAPH (FIG. 4)

pan. After an experience with the reaction mentioned, a container with lead walls and celluloid faces fastened together with celluloid cement was devised. This is illustrated in Fig. 5. These containers are easily made to suit any thickness of material and can be adapted for use with the faces horizontal as in Fig. 8, vertical as in Fig. 9 or at an intermediate angle, say 45°, as in Fig. 10.

To gain some idea of the smallest cavity which could be detected with certainty, a penetration meter was made, consisting of a set of aluminum strips 0.008 in. thick, fastened together with the ends offset to form a series of shallow steps. Fig. 12 shows (A) the penetration meter on a bar 1 in. wide and $\frac{3}{16}$ in. thick containing no tungsten, (B) a $\frac{3}{16}$ in. round rod of the same stock (C) a $\frac{3}{16}$ in. round rod containing 6 per cent tungsten, (D) a $\frac{1}{4}$ in. square bar containing 3 per cent tungsten, (E) a $\frac{1}{16}$ in. square bar containing 16 per cent tungsten and (F) a $\frac{1}{16}$ in. round rod containing 5 per cent tungsten, all immersed in $\frac{1}{2}$ in. of a 70 per cent solution of methylene iodide in benzene.

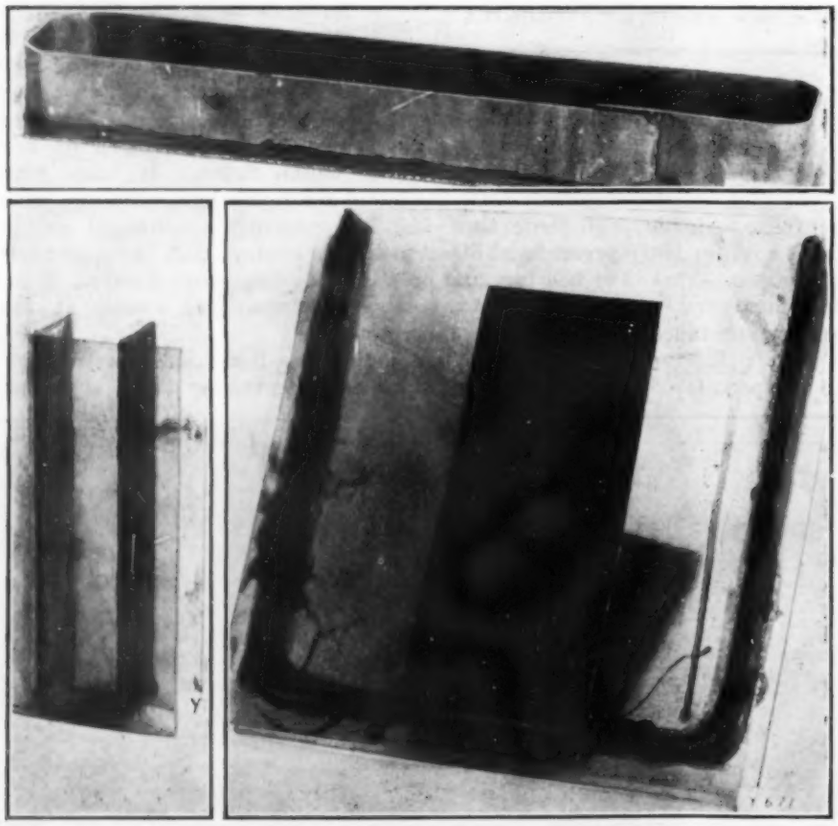
A single step of the meter makes a distinct difference in the density of the radiograph and as differences of the same character are observable in (B) it is evident that cavities only 0.008 in. thick can be detected. It it worthy of note that the outlines of bar D are distinguished with difficulty on account of the great similarity in transparency of this bar and the medium. This suggests the interesting possibility of supporting small objects in frames of sheet metal, say copper, and diluting the liquid till its absorption is the same as that of the frames. These would then not be visible in a radiograph.

This figure also exhibits the three types of cavities observed during the investigation. The spots in (E), the rounded portion of the large spot near the right



FIGS. 11 AND 12—SHOWING SENSITIVITY OF TESTS

hand end of (D) and the rounded part of the principal spot in (C) are blowholes. The jagged spots in (D), the transverse spots in (F) and the distinctly transverse spots in (B) are shrinkage cavities. The cloudy area near the left hand end of (F), the thread-like patches in (C) and the faint patches in (B) are spongy structures like those obtained with granular absorbers. No specimen had slag inclusions. Distorted remnants of these are, however, observable in Figs. 3 and 4. The straight filaments through the heads and even through the entire length of several of the $\frac{1}{16}$ in. bolts are due to slag which has been drawn out during the rolling. The fact that these are not further distorted in the bolt heads shows that these bolts were cut from hexagonal bars and not cold-headed. In the latter case they would have been spread out transversally like the flaw in the fragment of the $\frac{1}{2}$ in. bolt, which is known to have been cold-headed. The rest of the slag filament is probably in the other half of the bolt.



FIGS. 8, 9 AND 10—THREE FORMS OF CONTAINER FOR LIQUID ABSORBERS

Examples of Successful Testing

To show the variety of objects which have been examined in this way a few examples have been selected at random. Fig. 11 is a forging for a table-knife and Fig. 13 a set of races for ball bearings. Fig. 14 is a set of 98 forged balls for use with such bearings, 90 of which have no detectable flaw. The remaining 8 are faulty. Fig. 15 shows two plug gages of tool metal containing considerable tungsten cast upon steel cores. One of these has no detectable flaw, the other has marked defects within 0.02 in. of the surface. These radiographs were all made on the rough forgings before any machine work was done. The faulty balls and the defective plug gage were, of course, rejected. Without inspection the defect in the gage would have been encountered after considerable expensive machining, that is, in the course of manufacture. The flaws in the balls would probably have escaped attention till they failed in service.

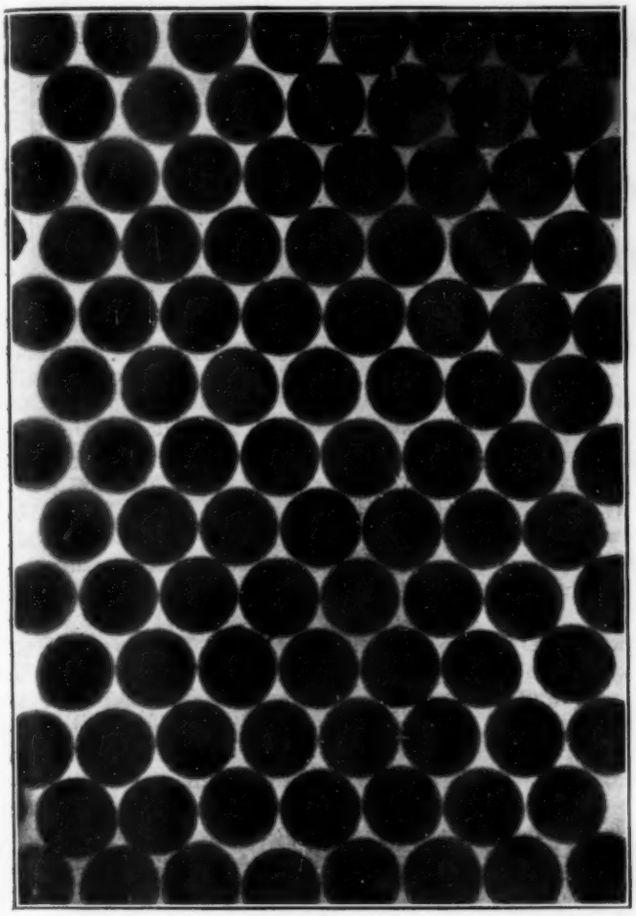


FIG. 14—SHOWING 98 BALL BEARINGS OF WHICH 8 ARE DEFECTIVE

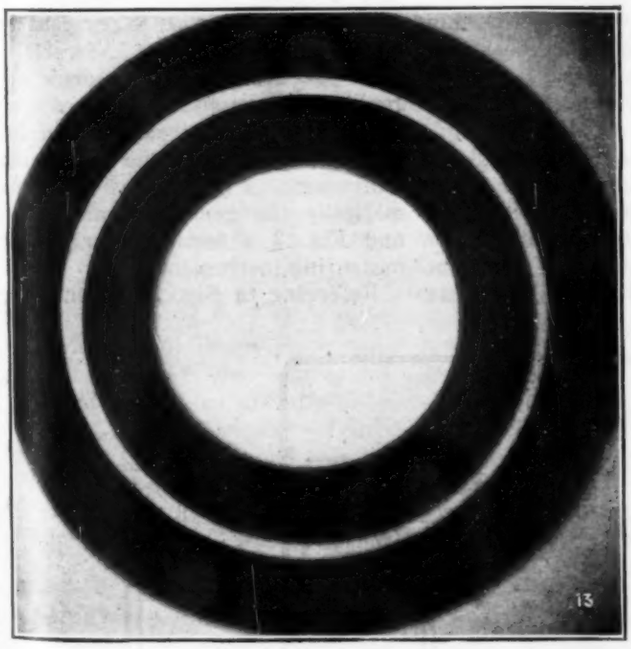


FIG. 13—SET OF RACES FOR BALL BEARINGS

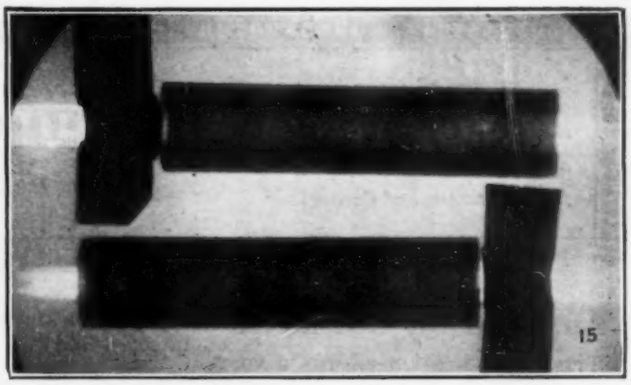


FIG. 15—PLUG GAGES CAST UPON STEEL CORES

These two examples illustrate two cases in which routine X-ray inspection may be justified. In the first it is a question of dollars and cents. If the manufacturing procedure cannot be developed so as to eliminate objectionable defects, and if the cost of machining before the eventual rejection is large compared with the cost of X-ray examination, inspection before the machining would be profitable. In the second case it may be a question of reputation, or even a question of human safety. In the latter case the cost should not figure. Routine inspection should not be expensive.

The value of radiographic examination in the development of new products and new processes cannot be too greatly stressed. A single radiograph gives more information as to the character and extent of cavities and inclusions than a great number, one is tempted to say than any number, of sectionings, and does so without damaging the specimen. It is thus possible to submit a specimen containing known defects to various mechanical tests and to relate the results to the internal structure disclosed by the radiograph, or to section it at the places most favorable for direct examination of the defects. This use of X-rays has been admirably discussed by Lester. (*Chem. & Met.*, Vol. 28, pp. 261-7, Feb. 7, 1923.)

For a long time the use of X-ray examination in the metallurgical industry has been limited by the comparatively thin specimens which could be penetrated successfully and by the difficulties encountered in mounting specimens of varying thickness or irregular shape. But in the paper referred to, Lester shows that steel three inches thick can be radiographed in a half hour with apparatus now on the market. When the demand justifies the expense the makers of tubes and generating plants will undoubtedly develop apparatus extending this limit considerably. In the present paper it has been shown that very good radiographs of objects of any external form can be secured with the new procedure and that the procedure itself is simple. The limitations hitherto imposed by shape have thus been removed. It is therefore permissible to say that any object which can be penetrated sufficiently by the X-rays can now be radiographed successfully.

In conclusion the writer wishes to acknowledge the able assistance of Leroy C. Werking who made most of the radiographs and contributed valuable suggestions during the search for the best absorbing medium, and the co-operation of W. P. Melville in improving the photographic technique.

Machinery and Appliances for Production and Control

Equipment News

From Maker and User

Materials and Accessories for Chemical Industries

An Electrical CO_2 Meter

The CO_2 indication affords a very convenient check on combustion efficiency; but for continuous indications the chemical absorption type of CO_2 meter is not always satisfactory, on account of its fragile construction, the time and trouble required to keep it in correct operation, the necessity of frequently renewing the chemicals, and the excessive time lag between the production and the analysis of the gas sample. In addition, a meter of this type must be placed rather close to the furnace, and cannot be made to give its indications at a distance.

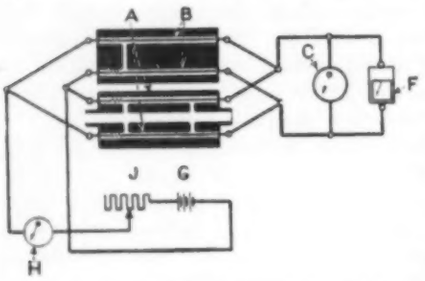


FIG. 1—DIAGRAM OF ELECTRIC CO_2 RECORDER

The S. & H. CO_2 meter, made by the Bacharach Industrial Instrument Co., of Pittsburgh, Pa., operates on a principle entirely different from the chemical CO_2 indicator; it makes use of the physical property of heat conduction of the gases. The arrangement of the meter is shown diagrammatically in Fig. 1. The "tester" consists of two sets of blocks, one set containing chambers *A* and the other chambers *B*. In the center of each chamber is a thin platinum wire, having at one end a small platinum-iridium spring for keeping the wire always central, regardless of heat expansion. *A* are the measuring chambers through which the flue gas passes slowly; *B* are the comparison chambers, containing air at room temperature. The electrical system is arranged in a Wheatstone bridge circuit, of which the four branches are the four platinum wires in the two blocks. Across the mid points of the bridge is connected the sensitive indicating galvanometer *C*. If desired, the recording galvanometer *F*, which may be placed at any reasonable distance from the measuring instrument, can also be connected into the circuit. The electrical energy is obtainable from a small storage battery *G* through a variable resistance *J*, which is adjusted to give constant current.

The flue gases consist of carbon dioxide (CO_2), carbon monoxide (CO), oxygen, nitrogen and water vapor, with traces of other gases. Nitrogen, oxygen, carbon monoxide and air have all practically the same heat conductivity, but CO_2 has 40 per cent less conductivity, and water vapor a conductivity about 30 per cent greater than that of air. The air in the comparison chamber is kept free from water vapor by the presence of hydroscopic chemicals, and the flue gases, having passed through a cooler (see below) which also acts as a drier, contain a very small, but practically constant, quantity of water vapor, hence the only variation occurring in the heat conductivity of the gases depends entirely on the percentage of CO_2 in the flue gas.

As the electric current flows through the platinum wires, the heat generated in them is transmitted through the gases to the walls of the chambers. The gases in *A*, containing CO_2, transmit the heat less readily than the air in *B*, and the wires in *A* become hotter than the wires in *B*; its resistance therefore increases, unbalancing the circuit and causing a deflection of the galvanometer, to an extent depending on the percentage of CO_2 present. The galvanometer is calibrated to read directly in percent of CO_2. Variations of room temperature influence the two systems of wires *A* and *B* in the two metal blocks in the same way and therefore do not affect the proper indication of CO_2, as the electric circuit of the Wheatstone bridge is unbalanced only by the difference in temperature between wires *A* and *B* established by the different heat conductivity of the air in the comparison chambers and the flue gas in the measuring chambers.

In this meter, time lag is practically eliminated. The interval between the drawing of the gas into the sampling tube and the indication of its CO_2 content never exceeds 2 minutes, as compared with very much longer time for other meters. The accuracy of the indication is guaranteed within $\pm \frac{1}{2}$ per cent of CO_2.

In practice, some accessories are required for auxiliary purposes such as cleaning the gas sample and for drawing it through the measuring instrument. Fig. 2 shows diagrammatically the general arrangement, and Fig. 3 a section through the measuring instrument.

Referring to Fig. 2, the flue gas

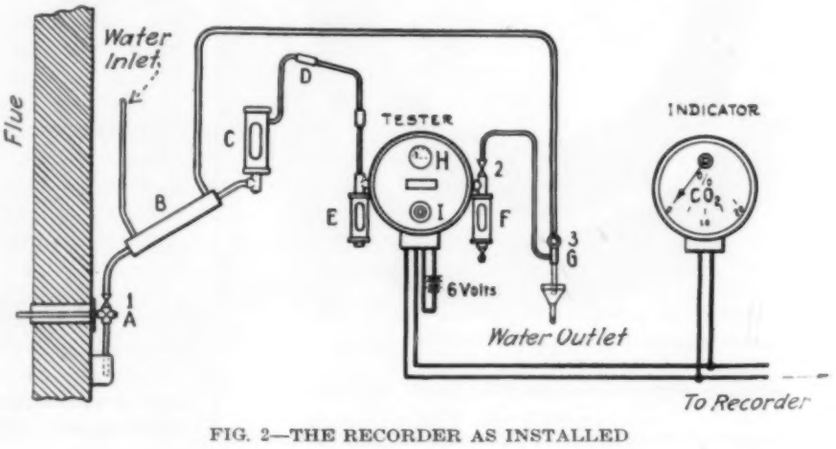


FIG. 2—THE RECORDER AS INSTALLED

sample is drawn through the tube *A* to the cooler *B*, in the outer jacket of which circulates water going to the aspirator *G*. From the cooler, the gas goes through the soot filter *C*, then to the measuring instrument

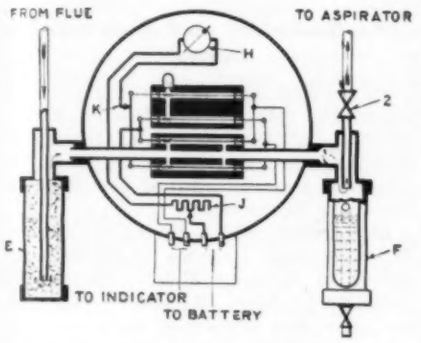


FIG. 3—CROSS-SECTION THROUGH TESTER

(the tester in Fig. 2). From this tester the gas passes to the aspirator *G* (Fig. 2). The latter is connected with the cock 2 to produce a suction of about 1 in. water column above the flue draft, thus insuring a practically constant rate of gas flow. For example, if the flue draft equals ½ in. of water column, the manometer *F* should indicate 1½ in. water column. Under these conditions the gas flow will be fast enough to insure a reasonably quick change of sample, but at the same time the flow will not be so fast as to influence the heat transfer from the wire. The electrical connections lead to the galvanometers, indicating and recording.

Each furnace should be provided with a separate, large indicator for

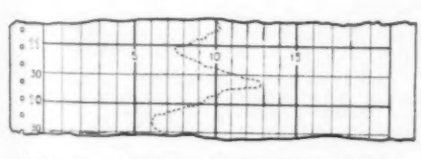


FIG. 4—SAMPLE OF CHART FROM RECORDER

the fireman. The recording instrument, located at any convenient point, may record on one sheet the indications from a number of different boilers. For a complete record, the stack temperature as well as the CO_2 content should be recorded on the same strip chart, with different colors.

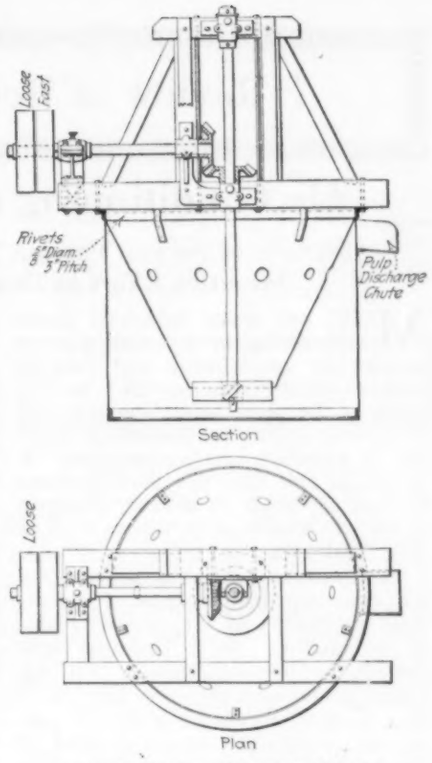
The above-described meter has also a more general application—for instance, in determining the amount of hydrogen in producer gas. Its action in this case depends on the high conductivity of hydrogen, which is seven times that of air. For such use, the meter is calibrated in percentage of H_2 for a given reasonably average percentage of CO_2 in the gas sample.

Returning to the use of the CO_2 meter for boilers and furnaces, its indications, with conditions of fairly constant load and quality of fuel, are sufficient for maintaining high efficiency of combustion, provided tests have been made with an Orsat apparatus to determine the most economical percentage of CO_2. In some cases, however, both the load and the fuel quality are exceedingly variable, and the percentage of CO_2 which at one rate of firing or with a given fuel is most economical may not correspond to the most efficient combustion with a different fuel or rate, on account of the loss caused by the production of CO. For these special cases, an electrical CO meter has been developed, which can be used simultaneously with the CO_2 meter, but operates on an entirely different principle; it will be described in a later issue.

Continuous Vortex Mixer

The type of vortex mixer to be described has proved so satisfactory for the pulping of dry, plastic or fluid clay slime in chemico-metallurgical operations that it would seem equally efficient for many other industrial purposes.

The illustration herewith is self-explanatory. The propeller shown consists of four straight blades set at 45 deg.; it is cheaper to make than the usual form of screw propeller and equally effective. The material to be pulped is dumped continuously or intermittently into the cone, being mixed there with water or solution, which flows in regulated amount. The discharge overflows at the spout leading from a calm zone, the surface of which is maintained at a higher level than that of the unmixed material in the cone, by reason of the pumping action of the propeller. Part of the flow of pulp escapes back into the cone through holes in the plate, whereupon it acts as a diluent to the dry or semi-d y material being delivered thereto. The difference in level between the holes in the cone and the overflow spout is sufficient to insure the continuous classification of the pulp and the return of unmixed lumps to the central portion of the apparatus, where they are subjected to the cutting and mixing action of the propeller blades. The size and number of holes in the cone are regulated so that sufficient pressure is maintained in the space between the cone and the outer cylinder to insure the elevation of the mixed pulp to the level of overflow. The speed of the propeller should be adjusted accordingly. It is advisable to provide a handhole and cover plate near the bottom of the cylinder, to facilitate the removal of pebbles or stones accidentally included with the material to be pulped.



CONTINUOUS VORTEX MIXER

Catalogs Received

INSULITE CHEMICAL CO., Aurora, Ill.—Two pamphlets, one entitled "Keeping Faith, the Story of Insulite Floors," the second entitled "Insulite AC Special," which describes refined elaterite.

BRITISH AMERICA NICKEL CORP., LTD., Ottawa, Canada—A new booklet describing the products and service of this company.

STEERE ENGINEERING CO., Detroit, Mich.—Pamphlet 249, describing Steere steel pipe and fittings for gas works.

THE EAGLE-PICHER LEAD CO., 208 S. LaSalle St., Chicago, Ill.—A folder describing the sublimed blue lead produced by this company.

DELAVAL STEAM TURBINE CO., Trenton, N. J.—Catalog H, describing the DeLaval company's line of multi-stage series pumps. This is a new line of centrifugal pumps manufactured by this company in which double suction impellers and volute diffusers are used, as in single-stage centrifugal pumps.

AMERICAN KRUEGER & TOLL CORP., 522 Fifth Ave., New York City—A booklet entitled "Wedge Optical Pyrometers," describing the design and use of this instrument which is a British made instrument handled in the United States by the above company.

Review of Recent Patents

Air Conditioning and Humidifying

Abstracts of Several Patents Which Indicate the Trend of Inventive Effort in This Broad General Field

MORE AND MORE, industrial plants are coming to use that type of central air conditioning and heating system which permits the various rooms in the plant being supplied with air having definite predetermined qualities of humidity and temperature. A system of this type has been patented by Leo L. Lewis (1,455,846, assigned to Carrier Engineering Corporation of New York, May 22, 1923).

This system claims to provide for the automatic maintenance of the desired conditions in the various rooms of a building. In a building tight enough to prevent leakage through walls, doors and windows and which thus permits accurate control of conditions, it provides for such relief of the internal pressure as is required to effect proper air change. When heating is necessary to secure the desired conditions, the system recirculates air and reconditions this return air, as far as possible, in order to save heat. When cooling is required, the proper amount of outside air is automatically admitted.

A Unit Air Conditioner

Another recent patent granted to the same patentee as the above (Leo L. Lewis, assignor to Carrier Engineering Corporation of New York, 1,458,985, June 19, 1923), covers a so-called "unit type" of air conditioning device for supplying humidified air to different departments, portions or rooms of buildings at the particular point where it is desired to use this air.

In this system, the humidifiers, heaters and fans are placed in the space where the air is to be used and are so designed that the whole apparatus may be affixed to the ceiling, thereby occupying the least used space. Central water pumping stations can be used where several of these unit systems are employed.

An Indicating and Regulating Device

It is often desirable to indicate and record the relative humidity in one or more closed spaces and at the same time regulate this humidity so as to maintain a predetermined condition in the space in question.

In a recent patent, Henry P. Clausen describes such a device (1,459,391, assigned to Western Electric Company, New York, June 19, 1923). In this invention two resistance elements in a split circuit are used, one of these elements being provided with a wick for maintaining it in a moist state. These elements each form an arm of a wheatstone bridge, and, by the resistance differential existing between them, they permit of the indication, regulation and consequent recording of the relative humidity. This was originally invented for telephone exchanges but applies in many other places.

American Patents Issued July 31, 1923

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff, and those which, in our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate our readers' interests and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

15,665—Temperature Control of Kettle by Zones. John George Lehman, Bethlehem, Pa., assignor to Bethlehem Foundry & Machine Co., Bethlehem, Pa., Original No. 1,407,666, dated Feb. 21, 1922.

1,463,154—Extraction Apparatus. Earl H. Cummins, Chicago, Ill., assignor to Dadant & Sons, Hamilton, Ill.

1,463,190—Method of Making Benzoic Acid and Salts Thereof. Edwin O. Barstow, Midland, Mich., assignor to The Dow Chemical Company.

1,463,206—Catalyst and Process of Making Same. Harry D. Gibbs, Penns Grove, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.

1,463,209—Process For The Manufacture of Acetic Acid. John E. Haggenmacher, Cleveland, Ohio, assignor to The Grasselli Chemical Company.

1,463,212—Process For The Manufacture of Concentrated Acetic Acid. Henry Howard, Cleveland, Ohio, assignor to The Grasselli Chemical Company.

1,463,228—Method of Manufacturing Wrought Iron. Albert Sauveur, Cambridge, Mass.

1,463,247—Metal Mold. Harold H. Brand, Cleveland, Ohio, assignor, by mesne assignments, to Aluminum Manufactures, Inc., Cleveland, Ohio.

1,463,255—Process of Preparation of Benzoates and Benzoic Acid From Dibenzyl. George Oliver Curme, Jr., and Herman Bunsen Heyn, Pittsburgh, Pa., assignors, by mesne assignments, to Union Carbide Company, New York.

1,463,273—Drawing Continuous Sheet Glass. Leonard D. Soubier, Toledo, Ohio, assignor, by mesne assignments, to The Libbey-Owens Sheet Glass Company.

1,463,279—Method of Drying Gases. Edwin H. Arnold, Coventry, and William T. Wakeford, Providence, R. I., assignors to The Nitrogen Corporation.

1,463,280—Ammonia Synthesis Autoclave. Edwin H. Arnold, Coventry, and William T. Wakeford, Providence, R. I., assignors to The Nitrogen Corporation.

1,463,309—Deodorizing and Improving The Quality of Cream And Butter Fat. Elmer M. Davis, Chicago, Ill., assignor to Swift & Company.

1,463,313—Japanning Apparatus. David F. Domizi, Cleveland, Ohio.

1,463,339—Process of Balling Scrap Metal. John M. Sellers, Downers Grove, Ill., assignor to Sellers Manufacturing Company, Chicago.

1,463,352—Apparatus For The Electrical Precipitation of Suspended Particles From Gases. Charles H. Weiskopf, Santa Monica, Calif., assignor to International Precipitation Company, Los Angeles.

1,463,362—Coating Machine. Charles L. Hooper, Robert F. Sutherland, and Albert W. Parkhouse, Rochester, N. Y., assignors to Vacuum Oil Company.

1,463,363—Cement-Kiln System. David S. Jacobus, Jersey City, N. J., assignor to The Babcock & Wilcox Company, Bayonne, N. J.

1,463,399—Manufacture of Refractory Products From Dolomite. Charles Arthur Longbottom, Worksop, and Frederick Lindley Duffield, Brassington, England.

1,463,438—Carbonizing Furnace. Nels Olsen, San Leandro, Calif.

1,461,483—Process For The Manufacture of Zinc White. Armand Nihoul, Villeneuve-le-Roi, and Camille Clerc, Paris, France.

1,463,508—Process of Recovering Soluble Compounds of Potassium and Aluminum From Silicates. Birger Fjeld Halvorsen, Christiania, Norway.

1,463,513—Electric Furnace. Charles L. Lee, Dayton, Ohio, assignor to General Motors Research Corporation, Dayton, Ohio.

1,463,528—Device For And Method of The Manufacture of Protected Inner Tubes For Tires. Albert Ennis Henderson, Toronto, Ontario, Canada.

1,463,529—Device For The Manufacture of Pneumatic Tubes. Albert Ennis Henderson, Toronto, Ontario, Canada.

1,463,542—Method And Apparatus For Finishing Leather. Arnold A. Angell, Chicago, Ill.

1,463,544—Cylinder Paper-Making Machine. George L. Bidwell, Riegelsville, Pa.

1,463,559—Sectional Electric Furnace. Edwin L. Smalley, East Orange, N. J.

1,463,575—Mold And Process For Forming Arcicles From Pulp or Other Plastic Material. Simon Cooper, Brooklyn, N. Y., assignor to Vacuum Pulp Products Corporation, New York, N. Y.

1,463,582—Drawing Glass Sheets. Halbert K. Hitchcock, Pittsburgh, Pa., assignor of one-half to Hitchcock Experiment Company.

1,463,609—Casting Oxidizable Metals. Adolf Beck and Karl Gersbach, Bitterfeld, and Oskar Hermann Weber, Griesheim-on-the-Main, Germany, assignors to the Firm: Chemische Fabrik Griesheim-Elektron, Frankfort-on-the-Main, Germany.

1,463,634—Cooling Bed. George Marshall Smith, Chicago, Ill., assignor to Interstate Iron and Steel Company, Chicago, Ill.

1,463,674—Composition For Impregnating Wood And Process of Preparing It. George Coester, Brunswick, Ga., assignor to Georgia Vita Ligno Co., Brunswick, Ga.

1,463,698—Oil Still. Philip Heffler, Pittsburgh, Pa., assignor of one-half to Harry C. Simmons, Crafton, Pa.

1,463,713—Electromagnetic Separation or Concentration of Minerals. William Morris Mordey, Westminster, England.

1,463,721—Pulp Dehydrator. Ray Adna North, Green Bay, Wis., assignor to E. Payson Smith, Green Bay, Wis.

1,463,754—Method of Manufacturing Tires. Carl E. Rett, Akron, Ohio, assignor to Lambert Tire & Rubber Co., Barberton, Ohio.

1,463,771—Means to Compress Ingots. Alvin A. Claassen, Chicago, Ill.

1,463,780—Composition For Coating And Bonding Fabrics. Herbert Frood, Chapel-en-le-Frith, England, assignor to Ferodo Limited, Chapel-en-le-Frith, England.

1,463,781—Filler And Accelerator For Rubber Compounds. Augustus Warren Gould, Mount Angel, Oreg.; Hazel Phelan executrix of said A. Warren Gould, deceased.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Some Developments in the Manufacture of Coke

Both European and American Inventors Are Active in This Important Field of Chemical Engineering

A SOURCE of coke which is occupying the thoughts of inventors more and more is the pitch from coal tar distilleries. Dr. Franz Puening of Pittsburgh (1,461,324, assigned to American Tar Products Co., of Chicago, July 10, 1923), has patented some improvements in his pitch-coking apparatus which promise to be of interest to those engaged in the art.

By utilizing the weight of the cover of the receptacle in which the pitch is coked and also the weight of the furnace roof it is claimed that a perfect seal is obtained so that leaks from the receptacle are prevented. This serves to eliminate the fires which have heretofore occurred from leaking pitch. In this manner the radiation through the cover of the receptacle is also reduced and the efficiency of the apparatus thereby increased. This permits the employing of lower coking temperatures, thus prolonging the life of the parts.

Manufacturing Metallurgical Coke

The structure of coke largely governs its adaptability to metallurgical processes. For blast furnace use it is desired to have coke in large firm pieces which are adapted to the proper loading of the furnace. Studies on how to obtain such coke have resulted in a patent being granted to André Henri Baille-Barrelle of Paris, France (1,458,964, June 19, 1923), in which an attempt is made to control the structure of the finished coke by controlling the method of heating the coke oven.

The method proposed in this process consists of raising the coal, which is being coked, as rapidly as possible to the temperature at which it commences to agglomerate. The heating is then carried on gradually and with such a degree of slowness that no such temperature difference shall exist in strata of the coal as to cause the establishment of a heat screen region. After the coal has become agglomerated throughout, the heating is then carried on rapidly until all the volatile matter has been driven off.

A Device for Low Temperature Carbonization

The low temperature process of making coke and securing the by-products of coal is the subject of much study at present. A step which may prove helpful in the solution of this problem has been made by Karl Prinz zu Loewenstein (1,460,024, June 26, 1923).

According to this process the material to be carbonized is fed in a thin stream onto a thin horizontal metallic disc. This disc is circular in form and is revolved slowly over a heating flue. A hood is provided over the apparatus to catch the distilled vapors and a scraper serves to remove the carbonized material. It is claimed that this process, which is continuous, provides a method in which the semi-coke will not stick to the heated surface. Also, the construction is inexpensive, compact, dustless and requires a minimum amount of power to operate.

Important Articles in Current Literature

More than fifty industrial, technical or scientific periodicals and trade papers are reviewed regularly by the staff of *Chem. & Met.* The articles listed below have been selected from these publications because they represent the most conspicuous themes in contemporary literature, and consequently should be of considerable interest to our readers. A brief résumé of each article is included in the reference given. Since it is frequently impossible to prepare a satisfactory abstract of an article, this list will enable our readers to keep abreast of current literature and direct their reading to advantage. The magazines reviewed have all been received within a fortnight of our publication date.

FROM COKE OVEN TO BYPRODUCT MARKET, ROSEDALE REFINERY. G. A. Richardson. A description of methods used in decanting the tar, taking ammonia and benzol from the gas and in the manufacture of ammonium sulphate. *Coal Age*, Aug. 9, 1923, p. 201-205.

SEED FLAX STRAW AS A PAPER MAKING MATERIAL. Edward H. Kellogg, Merle B. Shaw and George W. Bicking. A study of the possibilities of seed flax straw as a paper fiber showing that an easy bleaching pulp may be obtained which makes a fair sheet of wrapping or writing paper. *Paper Trade Journal*, Aug. 2, 1923, pp. 43-49.

INFLUENCE OF THE TEMPERATURES AT WHICH THE SOLUTION OF DYES IS AFFECTED UPON THE NATURE OF THE SOLUTION. Walter C. Holmes. A study, with graphs, illustrating the changes in absorption and other characteristics of certain dyes, as applied in practice and as affected by temperature. *Color Trade Journal*, August, 1923, pp. 54-56.

TREATMENT EFFLUENT SPENT LIQUORS —BRITISH REPORT. The problem in ammonia works gives rise to question of treatment of spent effluent, discussed by the Chief Inspector of Alkali Works in this article. *Chemical Age* (London), July 21, pp. 58-59.

STRENGTH OF STEELS AT HIGH TEMPERATURE. Part 2. H. J. French and W. A. Tucker. The discussion continued to cover Cobalt, Tungsten and Uranium Alloy Steels. *Iron Age*, Aug. 2, 1923, pp. 275-278.

L'EMPLOI DE L'ÉNERGIE ELECTRIQUE DONS LES MÉTHODS MÉTALLURGIQUES. Résumé de M. J. Cournot. Reports of three technical sessions of La Société des Ingénieurs Civils. A review of progress in the use of eelctrical power for metallurgical work. *Revue de Métallurgie*, July, 1923, pp. 417-456.

GRAPHITIC CORROSION OF CAST IRON. J. Vipond Davies. A discussion and argument for further investigation. *Engineering Foundation, 8th Annual Report*, pp. 36-41.

INTERNAL STRESSES IN METALS. E. P. Polushkin. A summary in the form of preliminary reports by this investigator with particular reference to the effect of internal stresses of modal lines. *Engineering Foundation, 8th Annual Report*, pp. 42-56.

THE FATIGUE OF METALS. H. F. Moore and T. M. Jasper. The second report abridged and partly rewritten from the University of Illinois, Engineering Experiment Station Bulletin 136. *Engineering Foundation, 8th Annual Report*, pp. 57-118.

TYPES OF LIME KILNS. A. E. Truesdale. A résumé of the types of kilns in use including pot, mixed feed vertical, Hoffman ring, funnel and rotary. *Rock Products*, July 28, 1923, pp. 23-25.

Book Reviews

Wood Distillation Industry

THE DESTRUCTIVE DISTILLATION OF WOOD. By *H. M. Bunbury*. 320 pages, with 107 illustrations and CXV tables. London: Benn Brothers, Ltd. Price, 35s. New York: D. Van Nostrand Co. Price, $8.50.

If there is one general criticism to be made on this book, it is that so much detail is given as to be confusing to the ordinary reader. The author shows a rather surprising lack of discrimination in the choice of material selected, and many tables of unimportant data are given which might well have been summarized in a few words. An uninitiated reader would have much difficulty in distinguishing between actual commercial practice and processes which have been described only in patent specifications or as a result of small scale experimental work.

A few examples will serve to illustrate these points: In Chapter II, under "The Woods Used for Distillation," many species are described which are unsuitable for wood distillation and never have been used for this purpose.

On pages 62 and 71 the results of experimental distillation of 48 species of Indian woods and 25 species of Australian woods are reported, although only one or two species were found to be promising as distillation woods.

On page 184 are given Lawrence's original data and curves on the loss of alcohol in the gases from the retort condensers. These figures do not correspond with the recorded vapor pressures of methyl alcohol at different temperatures.

On pages 257 to 268 there are described a number of processes, some of which never got beyond the experimental stage, while others are in actual commercial operation. The author, however, does not distinguish between these two groups.

There are also a few examples of lack of familiarity with the commercial conditions, particularly in America. On page 197 he states that different grades of acetate of lime are produced according to the demands of the market. The fact is that, in this country at least, only one grade is produced.

In no place is mention made of methyl acetate as a constituent of pyroligneous acid or crude wood alcohol, although a method for the determination of esters in crude wood alcohol

is given on page 296. Methyl acetate is actually a more important constituent than many of those mentioned.

The book seems somewhat weak on the topic of resinous wood distillation, but it must be admitted that there is much less published information available in this field.

In spite of these criticisms, the book will be very useful as a compilation of the literature on the destructive distillation of wood, including as it does references and abstracts of practically all publications on the subject. There are a large number of excellent illustrations, tables and charts, and the indexing, printing, binding, and general make-up are of superior quality. Only two minor typographical errors were noted. F. J. ROOT.

Readers' Views and Comments

An Open Forum for Subscribers

The editors invite discussion of articles and editorials or other topics of interest

Irrigation vs. Fertilization

SIR—The editorial on Irrigation vs. Fertilization in your issue of July 9 suggests that government money, and especially state money, could profitably be employed in demonstrating to farmers through the county agents the great importance of irrigation in the East. About one-fifth of the crops grown in the East have sufficient water to produce a maximum yield and about one-fifth or less too much water. The latter condition is the result of too much rain and cannot well be remedied, but the former can be remedied at a moderate cost in most cases. It goes almost without saying that the three essentials to full crop production are water, manure and soil; and these are stated in the order of their relative importance. A very large proportion of the arable land of the Eastern states is in the form of valleys through the center of which flow never failing streams, easily raised to sufficient levels to allow the water to be used on crops in time of drouth.

To a Western man familiar with Western practice it seems marvelous that large crops of lettuce, potatoes, tomatoes and other valuable crops should be allowed to fail for lack of water while this is flowing through the very valley in which the drouth prevails.

In the book "Our Farm in Cedar Valley" I have shown how it is possible to secure this needed water without the expense of pumping where the land is rolling, as it is in most cases in the Eastern states. Potatoes are bound to become one of our great crops on this high-priced land. The difference in the yield of potatoes between crops grown with and without sufficient water, especially with our hot summers, is enormous and worthy the serious attention of all farmers. EDWARD HART.

Personal

ERNEST ANDERSON, for the past 3 years professor of chemistry in the University of Nebraska, has resigned to become head of the Department of Chemistry in the University of Arizona, Tucson, Arizona.

DALE S. CHAMBERLAIN, professor of industrial chemistry, Lehigh University, will spend the ensuing year abroad in the study of industrial fuels. He plans to spend some time at the Imperial College of Science and Technology in London.

HOLDEN A. EVANS, Baltimore, Md., has been elected president of the Lorraine Petroleum Co., with local headquarters. He was formerly president of the Baltimore Shipbuilding & Dry Dock Co. C. WILBUR MILLER, president of the Davison Chemical Co., Baltimore, has been elected a director of the Lorraine company.

DR. COLIN G. FINK, associate professor of chemical engineering and head of the division of electrochemistry, Columbia University, addressed the American Electroplaters Society on "The Electrodeposition of the Rarer Metals" at their recent convention in Providence, R. I.

IVAR N. HULTMAN has recently been made chemist in charge of operations at the Kingsport plant of the Tennessee-Eastman Corporation. At the close of the war Mr. Hultman became associated with the synthetic organic chemical department of the Eastman Kodak Co. at Rochester, N. Y. About two years ago he was transferred as chemist at the Passaic Plant, Eastman Chemical Corp., which position he has held until the present time.

DR. J. LASH MILLER of Toronto, Canada, was the guest of honor at a dinner given at Los Angeles on July 26, by the Southern California Section of the American Chemical Society. Dr. Miller spoke on the "Method of Willard Gibbs in Chemical Thermodynamics."

JOHN A. MCNICOL, an official of the D. E. McNicol Pottery Co., Clarksburg, W. Va., has resigned, to become one of the heads of the American Sheet Glass Co., recently organized to operate a local plant.

C. H. PENNING, of the chemical section of the Tariff Commission, and M. Braun, of the Commission's staff of accountants, sailed Aug. 8, for Haiti, Santo Domingo and Jamaica, to investigate costs of production of logwood extract into which an investigation has been ordered following application for a change in duty.

FRANK PURNELL has been elected executive vice-president and assistant to J. A. Campbell, president, Youngstown Sheet & Tube Co., Youngstown, O. W. C. REILLY, heretofore general superintendent of the company, has been elected a vice-president, in charge of operations.

DANIEL H. RUPP, East Liverpool, O., city chemist, tendered an interesting address before the members of the local rotary club, July 31, on features of operation of the municipal waterworks plant near the state line.

F. O. SPRAGUE has resigned his position as consulting chemist of the Transylvania Tanning Co., Brevard, N. C., to operate a chemical laboratory for the tanneries of the Endicott Johnson Corp., Endicott, N. Y.

CHARLES T. BRAGG, formerly works manager for the Michigan Smelting and Refining Co., Detroit, is now associated in consulting practice with Col. Theodore A. Leisen, a past president of the American Water Works Association, and formerly manager of the Detroit Department of Water Supplies. The new firm is to be known as the Bragg Engineering Co. with offices in the General Motors Building, Detroit, Michigan.

Calendar of Coming Events

AMERICAN CHEMICAL SOCIETY, fall meeting, Milwaukee, Wis., Sept. 10 to 14.

AMERICAN ELECTROCHEMICAL SOCIETY, forty-fourth meeting, Dayton, Ohio, Sept. 27 to 29.

AMERICAN GAS ASSOCIATION, annual convention, Atlantic City, Oct. 15 to 20.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, winter meeting, Washington, D. C., Dec. 5 to 8.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, INC., Ontario and Quebec, Aug. 20 to 31.

AMERICAN MANAGEMENT ASSOCIATION, Hotel Astor, New York, Oct. 29-31.

AMERICAN SOCIETY FOR STEEL TREATING AND INTERNATIONAL STEEL EXPOSITION, Motor Square Garden, Pittsburgh, Pa., Oct. 8 to 13.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, annual meeting, New York City, Dec. 3 to 6.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, annual convention, New York City, Dec. 3 to 5.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS, iron and steel exposition, Buffalo, N. Y., Sept. 24 to 28.

NATIONAL ASSOCIATION OF PRACTICAL REFRIGERATION ENGINEERS, fourteenth annual convention, Memphis, Tenn., Dec. 12 to 16.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES (NINTH), New York, Sept. 17 to 22.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING, Grand Central Palace, New York, Dec. 3 to 8.

NATIONAL SAFETY COUNCIL, twelfth annual safety convention, Statler Hotel, Buffalo, Oct. 1 to 5.

Industry and Trade

Current News and Market Developments

Summary of the Week

August crop report shows flaxseed is making favorable progress and estimates of yield are increased.

Sales of nitrate of soda in Chile were of smaller volume in July than in June.

Revised regulations have been issued by Internal Revenue Bureau, governing margarine industry.

Higher wages for glass workers were agreed upon at annual conference of workers and manufacturers.

Bleaching powder is attracting more attention due to reports that prices have been shaded.

Tariff Commission is petitioned to lower existing duties on linseed and soya bean oils.

Strong sentiment in Canada in favor of embargo on pulpwood.

American Foundryman's Association honors J. H. Hall and Enrique Touceda.

Chemical Exposition plans taking shape rapidly; educational courses including movies to be provided.

Domestic makers of tartaric acid lower price of their product.

Freer offerings from foreign markets weakened quotations on palm oils.

Exports of chemicals and allied products for first half of year were 21 per cent higher than for first half of 1922.

Big Improvement in Export Shipments of Naval Stores

Totals for First Half of Year Show Material Gain Over Last Year—Foreign Trade in Paints and Varnishes Increases

THE gratifying gain in foreign demand for American naval stores that was made in the year 1922 was continued through the first half of 1923 when shipments to the value of $12,448,349 were sent abroad as compared with $8,031,121 during the first half of 1922. June was a particularly favorable month with a total of $3,220,829, far surpassing all previous months.

The value of the exports of rosin during the January-June, 1923, period exceeded those of the January-June, 1922, period, 81 per cent, when 630,126 barrels, valued at $5,978,810 were sent abroad. The countries of destination remained the same as those during the year 1922, the United Kingdom receiving 31 per cent, Germany, 20 per cent, Brazil, 13 per cent, Japan, 12 per cent, Argentina, 10 per cent and Canada, 6 per cent, with other European and Latin American countries also taking considerable amounts.

A 7 per cent drop in quantity but a 30 per cent rise in value characterize outward movement of spirits of turpentine during the periods under discussion. The United Kingdom was still our best customer, taking approximately one-half of the total shipments while the Netherlands has superseded Canada as to tonnage by having taken 475,985 gal., value at $538,416, or ⅛ of her total purchases for the year 1922. Argentina's requirements have gained considerably during this period.

The exports of rosin and turpentine for the first six months of 1923 by the chief countries to which shipped were:

To	Rosin Bbl.	Spirits of Turpentine Bbl.
United Kingdom	161,165	2,315,008
Brazil	67,288	88,704
Argentina	50,133	278,110
Japan	60,502	(a)
Germany	101,519	222,093
Dutch East Indies	34,455	(a)
Canada	30,636	418,365
Netherlands	11,058	475,985
Australia	4,841	136,565
Belgium	13,585	199,409
Total	630,126	4,513,049

(a) Not segregated in preliminary reports.

Foreign sales of wood turpentine fell off during this period from 264,608 gal., with a valuation of $207,177 in January-June, 1922, to 168,982 gal. with a valuation of $195,898 in January-June, 1923, while wood tar and pitch improved from $86,997 to $132,798. In addition to the above, $156,202 worth of turpentine substitutes were sent to foreign countries.

The figures covering the first half of 1923 for the exports of pigments, paints and varnishes points to the recovery of the foreign trade for these commodities. The gain of 47 per cent for the first six months of 1923 over the first six months of 1922 is most encouraging although it must be remembered that the depression in the trade was still evident a year ago, and it was not until the latter half of the year 1922 that strides were made.

Of the four groups expanding during this period, paints, stains and enamels represent the largest increase (57 per cent), with chemical pigments second (48 per cent), varnishes following with (37 per cent), and mineral earth pigments last (12 per cent). The only decline occurring in the individual items embraced by this class was in white and sublimed lead which fell from 5,407,031 lb., valued at $395,798, in the first half of 1922, to 4,261,554 lb., valued at $359,104 in the first half of 1923.

Exports of pigments, paint and varnishes for the first half of 1922 as compared with the first half of 1923:

	Jan.-June 1922 Lb.	Jan.-June 1923 Lb.	Value Jan.-June 1922	Value Jan.-June 1923
Mineral earth pigments, ochers, umber, sienna, metallic, whiting, etc.	13,796,592	15,445,392	$498,695	$558,602
Chemical pigments:				
Zinc oxide	3,795,819	6,455,853	290,464	445,441
Lithopone	1,909,041	1,995,288	103,091	111,894
Bone black	1,014,390	1,379,110	54,837	89,737
Carbon and lamp black	10,187,055	11,282,519	1,105,449	1,807,909
Red lead and litharge	1,582,525	2,314,377	129,676	236,734
White and sublimed lead	6,407,031	4,260,554	395,798	359,104
Other chemical pigments	2,472,927	3,556,074	187,852	296,877
Paints, stains and enamels:				
Enamel paints	560,175	1,191,109	159,017	320,339
Other ready mixed paints	Gallons 588,831	2,743,169	1,230,937	2,045,073
Other paints	Pounds 5,150,919	6,432,701	806,610	1,093,357
Varnishes	Gallons			
Oil varnishes	167,108	291,966	301,028	520,308
Other varnishes	229,377	210,240	302,841	307,259

A. F. A. Awards to Be Made in 1924

An Announcement of a Presentation to Be Made at a Special Session of the Next Convention of the Association

THE BOARD OF AWARDS of the American Foundrymen's Association announces that Enrique Touceda and John Howe Hall have been chosen as the first recipients of the John A. Penton and J. H. Whiting gold medals respectively. The presentation of these medals will be made at a special session of the 1924 meeting of the Association.

Mr. Touceda, who is to receive the John A. Penton medal, was selected because of his outstanding scientific achievements in connection with the development of the American malleable casting industry, and the J. H. Whiting medal is to be awarded to John Howe Hall in recognition of his valuable metallurgical developments and contributions of published information relating to the Steel Casting Industry.

Enrique Touceda, consulting engineer and Professor of Metallurgy at Rensselaer Polytechnic Institute, of which he is a graduate, has had many years of practical experience in the iron and steel field. In 1912, he became consulting engineer for the American Malleable Castings Association and it is in this connection that he has achieved some of his best known work. He was able to standardize the processes and analyses which gave the best results. With this as a basis, the A. M. C. A. established what is known as "Certified Malleable' with a certificate of quality being given only to those plants which maintained practices and standards agreeing with Professor Touceda's established standards. He has also led in the intensive research work which has been carried on with malleable cast iron.

ENRIQUE TOUCEDA, RECIPIENT OF THE JOHN A. PENTON MEDAL

John Howe Hall, metallurgist of the Taylor-Wharton Company, took his degree as a metallurgist in 1903 at Harvard University under Dr. Albert Sauveur. Besides the work which Mr. Howe has done with the Taylor-Wharton Co., he has been associated with the Bethlehem Steel Co., the Buffalo Crucible Casting Co. and the Quigley Furnace and Foundry Co. One of his metallurgical achievements has been the development of special manganese steels and the development of a method for melting ferro-manganese for use in the manufacture of manganese steel in the cupola instead of in the more expensive crucible method. Melting manganese steels in the electric furnace and special heat treating processes are further developments of Mr. Hall's.

JOHN HOWE HALL, RECIPIENT OF THE J. H. WHITING MEDAL

These awards were made possible by the establishment of four $5,000.00 award funds donated to the Association by four past officers—namely, W. H. McFadden, John A. Penton, J. H. Whiting, and the late Joseph S. Seaman. The administering of these award funds has been placed in the hands of an Award Board consisting of the last seven living past-presidents of the Association.

The Board of Awards would also like to have announced that if, at the 1924 Convention, a paper of outstanding merit is presented it will be recognized by conferring upon the author of the paper the W. H. McFadden medal of the A. F. A., presentation to be made at the 1925 Convention.

The fourth of these medals which have been made possible by generous contributions—the Joseph S. Seeman medal—will probably be presented at the 1925 Convention, but the Board of Awards is not prepared to make any final announcement regarding the conferring of the Seaman medal at the present time.

Acid Plant to Close

The Calumet & Arizona Mining Co. has served notice on the Arizona Tax Commission that the making of sulphuric acid at the company's smelter at Douglas, Ariz., will be suspended, probably within three years, when the oxidized ores of the New Cornelia Copper Co. at Ajo have been exhausted.

At one time the acid plant produced 200 tons of acid per day for Ajo, to which only 70 tons now goes. Freight rates to central points are too high to warrant shipment outside Arizona and no new acid-leaching plants are being planned.

A relatively small quantity of acid of high grade is being made at the smelter from roaster fumes, for the use of the Apache Powder Co., near Benson.

Data Given in Tariff Petitions To Be Made Public

On Wednesday the Tariff Commission modified its rules of procedure so as to make public, or at least to open to interested parties, information and data furnished by petitioners for changes in the tariff under the flexible provisions of the law. The regulations of the Tariff Act will be adhered to insofar as they apply to the restrictions against revealing confidential information such as individual costs, trade secrets, secret processes, etc. However, all other information will be available as a matter of public record. The new rule is expected to prove beneficial to all concerned. It should facilitate investigations into production costs of import commodities through its public hearings as parties desiring to present arguments in the various cases will be able to determine from the applicants' petition the facts on which the petition has been based. Heretofore, parties opposing an application for a change of rate have been limited in their knowledge of the case to the name of the applicant and whether an increase or decrease of duty was sought.

Lower Freight Rates to Pacific Coast Points

Permission to reduce freight rates from New York to the Southern Pacific Coast section by about 14 per cent on shipments routed via boat to Texas ports, and thence by rail over the Sunset-Gulf route, was given the Southern Pacific Railroad system last week by the Interstate Commerce Commission.

The lower rates will become effective Sept. 1 and will make rail and water rates from New York to the Southwestern territory and the Southern Pacific Coast equivalent to the rates which are now in effect from Chicago to the same destinations.

Practically all of the commodities which normally move from the Atlantic Coast to the Pacific Coast are affected by the reductions authorized, which will average 30c. per hundred pounds.

Washington News

Production Cost Investigation Makes Progress

The Tariff Commissions' Investigation Into European Product Costs Nearing Completion

C. R. DeLong, Chief of the Chemical Section of the Tariff Commission, sailed August 9 from England after having spent ten weeks in various European countries in connection with investigations into the costs of production of several chemicals. While Mr. DeLong will necessarily be absent during the hearing on the customs duty of casein, August 13, he will attend that on sodium nitrite which is set for September 10, and also subsequent hearings on chemical items the dates of which have not been fixed yet

Much of the data for which the party headed by Mr. DeLong was sent to Europe has been compiled and forwarded by mail to the Tariff Commission. The remainder will be gathered by the chemists and accountants who remain in Europe after Mr. DeLong's departure.

Not only did Mr. DeLong make investigations into specific commodities regarding which the Tariff Commission has ordered inquiries into costs of production, because of applications under the provisions of the flexible tariff, but he made a general survey of the chemical field in western Europe.

Changes in German Chemical Industry

A report from Stuttgart, Germany, forwarded by Consul M. K. Moorhead says that wages and salaries in Baden during the past months have increased to such an extent that certain chemicals can be imported at a price lower than it would cost to manufacture them in Germany, according to certain German chemical dealers. They further state that the occupation of the Ruhr district by the French authorities has brought about such a vast change in the German chemical industry that some of the commodities which previously had been on the German market are not now obtainable, and that they are unable to procure in Germany sufficient quantities of various chemical materials.

Stuttgart dealers claim that prices of chemicals in the occupied areas are approximately 50 per cent lower than in the unoccupied areas, which is due to an over-production in the occupied district and to a lack of markets. This is explained as a result of the customs control established. The result of the situation is that, while the occupied areas are overstocked and without available markets, the markets in the unoccupied German districts are practically stagnated for the want of particular commodities.

New Regulations Affect Margarine Trade

The Internal Revenue Bureau has issued revised regulations which have a wide bearing on the oleomargarine and butter substitute trades. These regulations fix the assessment of Federal taxes by manufacturers and dealers in those products. Branding of packages also is regulated with provision that persons entering upon the manufacture of oleomargarine or dealers entering upon the sale of such product after June 22, 1923, the date the revised regulations became effective, shall not, "except when necessary to comply with State laws," use on the packages the words "butter," "butterine," "dairy" or "creamery," or names of breed of cattle, trade names, labels, etc., "which convey or tend to convey the impression that the article is a product of the dairy." However, manufacturers and dealers who prior to the effective date of the regulations operated under names including any of the words prohibited are permitted to continue the use of their names.

Under the revised regulations manufacturers of and wholesale dealers in oleomargarine are required to enter in their monthly returns only the total amount of oleomargarine sold to each person each month, except in case of a sale to another wholesaler.

Ask Tariff Reduction for Linseed Oil

A petition, in behalf of the National Varnish Manufacturers Association and the Floor Covering Association of America, has been filed with the Tariff Commission, by John B. Gordon, secretary of the Bureau of Raw Materials for American Vegetable Oils and Fats Industries.

The petition asks for a reduction in duty on linseed oil, from 3.3c. per lb. to 2c. per lb. The petition enumerates many reasons why the duty should be lowered and stresses the advantage given to crushers by the existing duties on linseed and linseed oil respectively.

The Armstrong Paint & Varnish Works also have asked for relief from the present duty on linseed oil and also on soya bean oil.

Calcium Carbide in Ceylon

Consul M. M. Vance at Colombo states that there is a small but consistent demand for calcium carbide in the Colombo consular district. At present the United States is not represented in the list of suppliers of this product to Ceylon. Importers have been chiefly using carbide of Norwegian and Swedish manufacture. It is said that Switzerland and Japan are now entering the market and making their presence felt, although the product of the latter country is not considered of particular good quality.

The present buying price of all carbide is in the neighborhood of 17 rupees (the value of the American dollar today being about 3.255 rupees) per hundredweight. The retail market price ranges from 22 to 25 rupees. Local consumption amounts to about 50 tons a year.

Total Ceylon imports of calcium carbide for the year 1922 amounted to 946 hundredweight, valued at 17,956 rupees. Norway leads the list with more than half—561 hundredweight, valued at 10,795 rupees. Switzerland, Sweden, Belgium, Austria, and Denmark are the only other mentioned suppliers of this product, the quantity and value of imports from these countries being as follows: Switzerland, 100 hundredweight, valued at 1,864 rupees; Sweden, 78 at 1,483 rupees; Belgium, 40 at 720 rupees; Austria, 20 at 343 rupees; Denmark, 20 at 375 rupees; and other countries, 127 at 2,341 rupees.

Smaller Nitrate Sales in Chile

Less nitrate was sold in Chile during July than in June. The July sales amounted to 3,903,000 metric quintals, while the total sales from the first half of the year amounted to 8,554,000 quintals, the greater part of which were made following the fixation of prices for 1923-24 by the Nitrate Association in May. Production during June showed a slight increase over that of May, the figures for the two months being 1,552,000 and 1,500,000 metric quintals, respectively. However, the June, 1923, figure is an increase of 822,000 quintals over that of June, 1922, when there were but 33 plants operating, as compared with 70 in operation at present. Five plants have reopened during the past month. Total exports of nitrate during June were 1,453,000 metric quintals, while during the same period of 1922 there were but 342,000 quintals exported. Of a total production of 8,554,000 quintals for the first six months of 1923 there were exported 9,338,000 quintals.

Restraint Order Against Paint Companies

The use of the words "United States" in connection with products not made for or under the supervision of the United States Government is again condemned by the Federal Trade Commission. This ruling was handed down by the Commission in connection with the advertisement and sale of paints and varnishes which in this instance, the Commission found, were labeled with words including "United States" or "U. S." and accompanied by a picture of the figure known as Uncle Sam, which is popularly symbolic of the United States. The respondents named in the Commission's order are: Armstrong Paint and Varnish Works, of Chicago, Illinois; United States Roofing Paper and Paint Factories, Inc., of Minneapolis, Minnesota.

Favorable Progress of Foreign Trade in Chemical Products

Value of Export Shipments for First Half of Year Increases 21 Per Cent Over Corresponding Period Last Year

FAVORABLE progress has been made in the foreign trade in chemicals and allied products during the first six months of 1923—further proof of the recovery made in 1923, and of the basically sound condition of the industry—while another feature of the industry during this period has been the general rise in prices, according to a review of the period prepared by the Chemical Division of the Bureau of Foreign and Domestic Commerce. The review states that the exports of chemicals and allied products for the first six months of 1923 had an aggregate value of $75,125,022, an increase of 21 per cent over the first six months of 1922, and 67 per cent of the figure for the twelve months of 1922. June, 1923, with a total valuation of $14,120,330 has proved to be the record month, surpassing the previous high mark made in May by $754,748 and the figure for June, 1923, by $4,253,185.

Demand for Coal-Tars

As might be expected, the foreign demand for coal-tar products recorded the biggest increase (68 per cent) of all the general groups, during the first half of 1923. The total exports of coal-tar products for the six months January-June, 1923, amounted to $6,324,995, 83 per cent of the total for the twelve months of 1922. The figures, month by month, for all coal-tar chemicals exported in 1922 as compared with 1923 were:

	1922	1923
January	$546,234	$640,758
February	338,629	986,545
March	925,468	1,133,815
April	827,496	1,098,615
May	586,730	1,270,611
June	549,899	1,194,651

Foreign sales of benzol gained 24 per cent in value from the corresponding period of 1922, and equalled 77 per cent of the value for the entire year of 1922. The shipments of aniline oil and salts amounting to 411,417 lb., valued at $73,716 for the first six months of 1923 grew 17 per cent in quantity and 52 per cent in value and surpassed the shipments of the complete year of 1922 by 69,597 lb., valued at $8,080, while naphthalene dropped 20 per cent in quantity and 15 per cent in value, but equalled 44 per cent of the quantity and 57 per cent of the value shipped during 1922.

Although lesser quantities of coal-tar colors, dyes and stains were shipped to foreign countries during June than during the previous months, the total for the half year of 1923 expanded over 200 per cent in quantity and 60 per cent in value as compared with the first half of 1922 and were but slightly under the figures for the entire year of 1922. In the January-June, 1923, period, 8,289,136 lb., valued at $2,709,742, were sent abroad. Foreign demand for American coal-tar medicinals for January-June, 1923, was but half that for January-June, 1922, and but one third of the figure for the twelve months of 1922. During this period photographic chemicals also fell off, from 150,618 lb., $55,124, January-June, 1922, to 129,089 lb., $45,728 for January-June, 1923.

Foreign sales of acids and anhydrides failed to reach the January-June, 1922, figure of 16,820,619 lb., with a valuation of $729,435, by 5,983,535 lb., $170,393, sharp declines having occurred in both sulphuric and boric acids, while an advance appeared in "all other acids and anhydrides."

The outward movement of the trade in wood and denatured alcohol has been favorable, having more than doubled in the values sent abroad during the first half of 1923 as compared with the first half of 1922, and having fallen short of the $922,700 figure for the entire year of 1922 by but $120,463 or by less than one-seventh of the total for that year.

Among the heavy chemicals which showed expansions in 1922 and which have continued to gain in 1923, are ammonia and ammonium compounds, aluminum sulphate, baking powder, dextrine or British gum, and washing powder and fluid. Acetate of lime and bleaching powder have each advanced in value, but declined in tonnage.

On the other hand during the first six months of 1922 rather large decreases were evident in the exports of calcium carbide, copper sulphate, and glycerin, all of which chemicals, however, had recorded increases during the year 1922.

The exports of these chemicals for the first half of 1922 as compared with the first half of 1923 were:

	January-June 1922 Lb.	January-June 1923 Lb.
Ammonia and ammonium compounds	2,287,454	3,415,170
Aluminum sulphate	12,066,218	17,308,240
Baking powder	1,458,233	2,091,627
Acetate of lime	16,510,592	15,501,117
Calcium carbide	8,919,285	3,293,775
Bleaching powder	17,203,797	16,792,974
Copper sulphate	4,132,793	1,417,374
Dextrine or British gum	7,717,670	8,803,293
Formaldehyde	1,041,632	690,070
Glycerin	1,871,167	697,261
Potash bichromate	3,176,760	2,231,428
Potash, chlorate of	303,451	131,585
Washing powder and fluid	1,891,123	3,127,943

No significant changes were made in the foreign demand for sodas and sodium compounds as a group, during the periods under discussion, 203,819,410 lb., valued at $5,278,279 were shipped abroad from January-June, 1923, as compared with 184,419,888 lb., valued at $5,858,666 in January-June, 1923, and 348,827,893 lb., valued at $10,222,634 in the year 1922.

Advances were made in all the individual items under this group except in exports of caustic soda, which dropped one-third from 89,607,806 lb., $3,302,943 in January-June,1922, to $58,703,050 lb., $2,093,273 in January-June, 1923. Sodium cyanide rose from 1,642,113 lb., with a value of $121,586 in the first half of 1922, to 2,685,678 lb., with a value of $277,858 in the corresponding period of 1923; soda ash, from 14,121,207 lb., $320,271, to 14,350,720 lb., $340,959; sodium silicate, from 12,966,206 lb., $136,494 to 15,266,533 lb., $143,195; sal soda, from 5,288,204 lb., $87,327, to 6,010,714 lb., $87,589; and sodium bicarbonate from 7,810,526 lb., $173,772 to 8,803,387 lb., $203,578.

The big jump as registered in exports of borax for the year 1922 was again evident in the six months of 1923 although the rate of increase was reduced from 300 per cent to 210 per cent for quantity, and from 200 per cent to 139 per cent in value, total shipments for the six months of 1923, having been 21,770,090 lb., $880,447.

Foreign sales of sulphur declined from 255,675 tons, valued at $3,754,366 in January-June, 1922, period, to 243,511 tons, valued at $3,644,599 January-June, 1923.

Gain for Explosives

Foreign demand for explosives has gained 10 per cent over the first six months of 1922 with total exports equalling $1,742,839 (11,107,573 lb.). Dynamite the most important commodity in this group, advanced nearly one third in quantity, but declined very slightly as to value, 9,465,288 lb., $1,390,777 for the first six months of 1923. Smokeless powder shipments amounted to 266,044 lb., valued at $121,033; gunpowder other than smokeless, to 193,740 lb., valued at $62,334; and blasting powder, to 571,504 lb., valued at $54,054.

The large gain made in exports of pyroxylin products is but one indication of the general increase in consumption of these products. For the first half of 1923, 1,046,281 lb., $1,297,492 of pyroxylin products in blocks, sheets or rods, and 363,826 lb., $471,991 of manufactures were exported.

Exports of fertilizers and fertilizer materials advanced 21 per cent during the first half of 1923, from $9,423,504 (496,801 tons) in first half of 1922 to $11,382,529 (550,953 tons) in first half of 1923, and equalled ⅘ of the total shipments of 1922.

The lack of sufficient quantities of sulphate of ammonia to supply the foreign requirements may account for the drop of 3 per cent in quantity, but the rise of 21 per cent in value. The shortage was particularly true during the first quarter of 1923. The Far East including Japan, which took nearly ⅔ of our total shipments, offered the best market while Cuba furnished a good near at hand market. In addition to this material, there were sent abroad 19,050 tons, valued at $968,014, of other nitrogenous fertilizers.

Shipments of bones, hoofs, and horns, unmanufactured, expanded over 30 per cent in the first six months of 1923, from 2,536,256 lb., valued at $129,865, in January-June, 1922, to 3,309,706 lb., valued at $178,899.

New Color Index Nearing Completion

Work of British Society to Cover Broad Field Including Nearly All Dyes of Industry

The new "Colour Index" now approaching completion will add greatly to the usefulness of the work of the Society of Dyers and Colourists. That there should be a thoroughly up-to-date and comprehensive index of dyes is extremely desirable, but up to the present the best available authority has been a German pre-war publication, now inevitably far from complete. In order to remedy this defect, the Society of Dyers and Colourists, whose headquarters are at Bradford, England, decided to undertake the work of compiling a comprehensive color index. The work of editorship was placed in the hands of Dr. F. M. Rowe, of the Manchester College of Technology, assisted by Mr. C. Lea, and a Revision Committee was formed under the chairmanship of Mr. Ernest Hickson, of Bradford, on which the leading dyestuff manufacturers and dyestuff users of all classes were represented, as well as the leading professors and experts on the technical side.

The color index has been published in monthly parts, the first being issued in September, 1922. Fourteen parts are required to complete the index. The ninth has been issued and the material for the remaining parts is being printed. One of the features of the index when completed will be the comprehensive indices which it will contain. These will cover the names of many thousands of commercial dyes, and will also deal with the patent numbers, the intermediate products used and so on. The number of distinct synthetic dyes dealt with will exceed 1,320. Most of these dyes have a number of commercial names, many of them thirty or more, and in all cases these names and the respective makers are given. The products of over a hundred color making firms are included and the matter covers 700 large pages of closely printed and condensed matter.

A dye-user who requires a particular dye can find a complete list of the manufacturers who make it, the scientific name of the product, its components and formula, details of its preparation, its discoverer, exhaustive references to the literature on the subject, its properties, uses and modes of application.

In addition to the synthetic dyestuffs, the color index will include the principal coloring matters and the pigments. Dyes are used not only in the great textile industries, but in a large number of other industries, such as the paint and varnish, paper making, soap and oil, in photography, medicine and foodstuffs. Details are given of dyes specially used in photography, which have not been included in any previous work. There are some particularly valuable references to the suitability of dyes for calico printing.

Larger Pulp Wood Consumption

Preliminary statistics compiled by the Census Bureau and the Forest Service show that the total consumption of pulp wood was 5,548,842 cords by 241 mills in 1922, as against 4,557,179 cords by 254 mills in 1921. The consumption of wood in 1922 increased 21.8 per cent, compared with the previous year, but decreased 9.2 per cent, compared with the consumption for 1920, which year was the most active of record in the industry.

More than 54 per cent of the wood consumed in 1922 was spruce. Hemlock and yellow pine were next in importance, supplying 16.1 per cent and 6.7 per cent, respectively, of the total quantity of pulp wood used in that year. The production of wood pulp was 3,521,644 short tons in 1922, compared with 2,875,601 tons in 1921. Of the total amount in 1922, 1,483,787 tons were produced by the mechanical process, 1,374,319 tons by the sulphite process, 419,857 tons by the soda process, and 243,681 tons by the sulphate process.

Maine, Wisconsin and New York are the leading States in this industry. In 1922 these three States reported 56.8 per cent of the total consumption of pulp wood and 59.7 per cent of the total production of wood pulp.

Americans Supply Paraffin Wax To Constantinople Market

Wm. A. Yoder, clerk to the trade commissioner at Constantinople, reports that the annual consumption of paraffin wax in Constantinople is between 1,000 and 2,000 sacks, of which 75 per cent is supplied by American firms and the remainder by Rumania. Paraffin is used there mainly in the manufacture of waxtapers for religious purposes, very little being taken by ship chandlers for supplying vessels touching at this port.

The trade in paraffin wax on the Constantinople market has declined greatly since 1921. During 1920 and 1921 approximately 600 tons of this article were shipped to Russia by way of Constantinople, while during the same period Rumania and Bulgaria took a total of 700 tons. However, Russia and Rumania are now again able to supply their own requirements for paraffin. In Bulgaria an American company has established warehouses and stocks at the seaport of Burgas, whence paraffin is distributed to the rest of the country.

Investigate Mineral Oil Costs

A. G. Maguire, chairman of the committee which was appointed by the National Petroleum Marketers' Association, to investigate conditions in the mineral oil industry in the mid-continent oil fields, has named three sub-committees. The sub-committees will investigate costs of producing, refining and marketing crude oil and its by-products.

Will Canada Place Embargo on Her Pulpwood?

Both Sides of Question Strongly Supported — Ability to Supply United States Questioned

The Canadian Government has a huge correspondence in regard to the proposed embargo on the exportation of pulpwood and action is to be taken by the Government at its sitting this week. The greater volume of the representations is commendatory of the prohibition proposed, but vigorous protests come from the United States paper industry as well as from Canadian interests concerned in the export of the pulpwood. By both of them it is set forth that an embargo would be an unwarranted restriction on trade between the two countries.

It is settled that nothing will be done until a Royal Commission makes a complete survey of the whole situation and ascertains the exact relation between exportation of pulpwood and the depletion of the resources in that line. It is claimed in some quarters, that compared with domestic consumption and fire losses, exportation is a much smaller factor.

The situation brought about by the embargo talk has given rise to much speculation as to Canada's ability to continue supplying the United States with pulpwood. It is estimated that Canada has 250,000,000 acres of forest growth of merchantable size, and 600,000,000 forested acres of young timber suitable for pulpwood. It is assumed that the 600,000,000 forested acres of young timber would yield 1,250,000,000 cords of pulpwood. The present consumption is 4,000,000 cords per annum. On that basis the supply would last for over 300 years, without allowing for from two to three per cent of regrowth; but at that point the authorities differ. It is stoutly maintained by some experts that Canada has not as much pulpwood in sight as is supposed, and that on the basis of consumption during the past twenty years in particular, the resources would be exhausted in 60 years, or reduced to a volume which would mean exceedingly high cost for pulp.

France and Austria Effect Tariff Agreement

A commercial treaty between France and Austria was signed June 22 and is effective for one year from July 22, subject to ratification by the French Parliament. Austria grants special rates to French products. France grants the lowest rates of its tariff to certain Austrian products, but reserves the right to make more favorable agreements with the other late enemy powers in order to facilitate the reparations payments. France also accords Austria fixed percentage reductions from its general tariff on 90 articles of importance. Other provisions of the arrangement relate to trade-marks, certificates of origin and commercial travelers.

Announcement of Student Courses at Exposition

Program of Subjects, Speakers and General Plans Made Public

Announcement was made to students in colleges throughout this country where courses in chemical engineering or industrial chemical practice are being given of the course on the fundamentals of chemical engineering and industrial chemical practice at the Ninth National Exposition of Chemical Industries, Grand Central Palace, New York September 17-22, 1923. Students of chemistry and chemical engineering were invited to enroll in this short course given under the direction of a committee of educators. This committee is under the Chairmanship of Prof. W. T. Read, of Yale University, a member of the advisory committee.

Lectures will be given by men prominent in various phases of the chemical engineering industries. They will be supplemented by group conferences and supervised inspection of the exhibits. A report or examination on certain phases of the course may be required by the committee.

The following topics will be included in the course:

1. PLANT EQUIPMENT IN THE CHEMICAL ENGINEERING INDUSTRIES:
   - (a) Disintegration — Crushing and Grinding.
   - (b) Mechanical Separation—Grading.
   - (c) Separation of Solids from Liquids—Thickening, Filtration, Centrifugal Separation.
   - (d) Separation with Phase Change—Evaporation, Distillation, Drying.
   - (e) Handling of Materials.
2. MATERIALS OF CONSTRUCTION:
   What material to use, when, where and why.
3. CHEMICALS IN COMMERCE:
   The distribution of chemicals.

At this time the preliminary announcement of speakers for the above subjects is made as follows: Subject (a) and (b) will be generally discussed by Galen H. Clevenger, an engineer prominent in this work. Subject (d) will be discussed in general by Professor W. H. McAdams, of Massachusetts Institute of Technology, whose recent work and co-authorship of "Fundamental Principles of Chemical Engineering" created such stirring interest in technical circles. Subject (e) will be discussed by A. E. Marshall of Baltimore and other speakers upon the same subject will be Harry Carlson on "Conveying with Steel Belting," S. G. Ketterer on "Pumping by the use of the Jet Apparatus," and G. L. Montgomery, discussing "Intra-Plant Transportation in the Chemical Industry."

Subject 2 will be broadly discussed by W. S. Calcott, chemical engineer of the du Pont Company and other speakers will be Ross C. Purdy, Secretary of the American Ceramic Society,—"Ceramic Materials: clay, glass, silica and enamelware" and O. I. Chormann, "Glass, Enamel, Steel Products as Materials of Construction"; also Homer Hendricks, "Zinc as a Material in Construction."

There will be no charge made to the students attending this course and already through their instructors, (through whom registration cards may be secured), over 150 students have applied for admission to this course.

In view of this wide interest Columbia University has offered the use of its dormitories to the students attending this course during the week of the Exposition, making a special rate to these students.

Later information concerning this course with fuller details regarding the speakers will be published as it is received and students are recommended to communicate with their college instructors if they desire to avail themselves of this course.

Northern New York Chemists May Organize Further

Initial steps looking to the formation of a permanent intersectional organization of the northern New York sections of the American Chemical Society have been taken. At a meeting held at Syracuse in June an intersectional committee was appointed to canvass the situation and present a tentative set of by-laws at the annual Geneva gathering, which will take place at the New York State Agricultural Experiment Station on Saturday, Sept. 29.

The second intersectional meeting will be in the nature of a symposium to be held in Syracuse either on Jan. 25-26, or Feb. 1-2, 1924. The subject for this meeting will be "Metals." Friday will be devoted to a program of papers on this general topic. Some eminent man will be secured to give a public address on Friday evening for the benefit of the public of Syracuse. A special feature of the Saturday morning session will be topical educational meeting for the discussion of the teaching of chemistry in secondary schools.

Higher Wages for Glass Workers

The annual wage conference between representatives of the American Flint Glass Workers' Union and the National Association of Manufacturers of Pressed and Blown Glassware held at Atlantic City was concluded last week with the granting of sweeping concessions to the men for the next agreement going into operation Sept. 1.

The union was granted an increase ranging from 5 to approximately 18 per cent in 13 of the 15 departments of the trade. Prevailing wages in the electric bulb department remain the same. The lamp working conference was not completed at adjournment here because it was necessary for some of the manufacturers to return home and another meeting will be called at an early date. The men are seeking an advance of 15 per cent in wages and a 44-hour week.

Steel Treaters Make Ready for Fall Session

To Meet at Pittsburgh Oct. 8 to 13—Live Program Promised—Steel Exposition at Same Time

The fifth annual convention of the American Society for Steel Treating and the International Steel Exposition held under the auspices of the Society will take place in Motor Square Garden, Pittsburgh, Pa., during the week of October 8th.

More than 20,000 individuals attended the convention and exposition last year at Detroit who, it is expected, will need no special introduction to the coming event at Pittsburgh, inasmuch as it is now recognized as an important event in the iron and steel industry.

The railroads of the country are offering fare and a half for the round trip, but in order to obtain benefit of this reduced fare it is necessary to write to the headquarters of the Society at Cleveland and obtain a certificate for presentation when purchasing transportation.

Many leaders in the industry are to furnish the papers for the program to be presented during the five day technical convention. Papers have been secured from Japan, England, France and Germany, and these combined with the large number of papers to be presented by several American metallurgical engineers, all combine to make the prospects for strong technical sessions very good. The program will be published in an early issue of *Chem. & Met.*

Canada To Treat Inventors More Liberally

The provisions of the new act, which will govern the granting of patents in Canada after August 31, have just been published by the Federal Patent Department. The new regulations are more liberal in consideration extended to inventors. Summed up briefly, the most important departure from the old legislation are extension of the time limit set for the manufacture of the patented device; provision for one partner in an invention to secure a patent upon it under certain conditions; making registration of patent attorneys obligatory, and reducing the amount of fees and the danger of permitting the patent to lapse through failure to pay a second fee installment.

Reorganize Magadi Soda Co.

Advices from London state that plans are well underway for the reorganization of the Magadi Soda Co., Ltd. H. J. Stephens, secretary of the committee in charge of the affairs of the company, recently issued a circular in which he states that reorganization plans call for a heavy assessment on stockholders. It is also stated that practically all of the original directors are no longer connected with the company.

News Notes

Parties of chemists and surveyors are now working at Regina Beach and Inglebright, Sask., on deposits of sodium sulphate. The work is under the supervision of I. M. Cole, research chemist of the Dominion Department of Mines. The work of the parties is to estimate and classify the deposits within the province.

At Sault Ste. Marie, Ont., the council of the Board of Trade recently discussed the probability of the establishment in the Soo of a million dollar plant for the manufacture of acetylene gas by a French company with headquarters in Paris. The company has stated it will locate in Canada in case a sufficient market can be secured for its output.

Oil has been struck in the well of the Border Oil Company, four and one-half miles east of Coutts and a few miles from the international boundary, according to reports from Calgary, Canada. The report states that when the strike occurred the drill was down 1,870 feet and the hole was only 1½ inches in diameter.

The General Refractories Co., Pittsburgh, Pa., is disposing of a stock issue of 45,000 shares, to total $2,250,000, the proceeds to be used for the acquisition of the properties of the American Refractories Co., as recently arranged, at Danville and Joliet, Ill., Baraboo, Wis.; and Baltimore, Md., as well as for proposed extensions. William C. Sproul is president.

The Athabasca bituminous sands formed the topic of some recent remarks by Dr. K. A. Clarke of the research branch of the University of Alberta. Dr. Clarke is sure that these sands will provide an eventual supply of petroleum products for the use of Alberta residents.

Galvanized iron utensils as a source of food contamination is the subject of a recent warning of the U. S. Department of Agriculture. It has been found that when such substances stand for only a short time in galvanized containers they become impregnated with zinc salts. Consumption of foods so contaminated is liable to cause sudden and intense illness.

Briquet Fate Not Settled

The conference of representatives of the Manitoba, Saskatchewan and Dominion Governments to determine the future policy with respect to tests being made at Bienfait on the briquetting of coal ended without any definite decision being reached. It is understood another meeting will be held some weeks hence, after R. A. Ross, the chairman of the Lignite Utilization Board, has been consulted on several matters of a technical nature which were brought before the conference.

Indicated Flaxseed Production Raised to 19,100,000 Bu.

According to the August 1 report of the Department of Agriculture, issued on Tuesday, the flaxseed crop in the Northwest is making good progress and the indicated yield is placed at 19,100,000 bu., against 18,000,000 bu. a month ago. Condition went off slightly, but the estimated yield per acre was raised to 8.3 bu., comparing with 7.9 bu. a month ago and 8.5 bu. a year ago. The indicated yield shows a substantial increase over the previous year's total when the crop was placed at 12,238,000 bu.

Flaxseed crop comparisons follow:

	Acres	Crop (Bu.)
Aug. 1, 1923	2,285,000	19,100,000
July 1, 1923	2,285,000	18,000,000
Aug. 1, 1922	1,341,000	11,400,000
Final, 1922	1,308,000	12,238,000
Final, 1921	1,108,000	8,112,000
Final, 1920	1,757,000	10,744,000
Final, 1919	1,683,000	7,256,000
Final, 1918	1,910,000	13,369,000
Final, 1917	1,984,000	9,164,000
Final, 1916	1,474,000	14,296,000
Final, 1915	1,387,000	14,030,000
Final, 1914	1,645,000	13,749,000

Exposition Movies Announced

The management of the coming ninth annual Exposition of Chemical Industries, to be held Sept. 17th to 22 at the Grand Central Palace, New York City has announced a tentative program for motion picture to be exhibit during the week.

This program will be an elaborate and interesting one, and already contains the following films; "The Story of Duriron as a Non-Corrodible Material for Chemical Apparatus" (1 reel) Courtesy of the Duriron Company.

"Operations of a Nickel Rolling Mill Producing Sheet and Wire." (5 reels) Courtesy of International Nickle Company.

"The Story of Sulphur and how it is Secured." (2 reels) Courtesy of U. S. Bureau of Mines and Texas Gulf Sulphur Company.

"The Story of Asbestos and its Manufactures." (4 reels) Courtesy of the Johns-Mansville Company and U. S. Bureau of Mines.

"Saving Coal in the Home." (1 reel) Courtesy of U. S. Bureau of Mines.

"The Diary of an Abrasive Stone" (4 reels) Courtesy of U. S. Bureau of Mines and Carborundum Company.

"Water Power" (2 reels) Courtesy of U. S. Bureau of Mines and Westinghouse Electric and Manufacturing Company.

"The History of Transportation" (2 reels) Courtesy of U. S. Bureau of Mines and Westinghouse Electric and Manufacturing Co.

"The Story of Motor Truck Transportation" (3 reels) Courtesy of U. S. Bureau of Mines.

"Story of Steel" (6 reels) Courtesy of U. S. Bureau of Mines.

"When Wages Stop: Showing Safety First in the Petroleum Industry" (4 reels) Courtesy of U. S. Bureau of Mines.

Trade Notes

The formation of a rubber trust in Russia has been sanctioned by the Labor and Defence Council. The newly formed organization is capitalized at 73,740,000 gold rubles.

The Tennessee Eastman Corp., subsidiary of Eastman Kodak Co., of Rochester, is spending several hundred thousand dollars at its Kingsport, Tenn., plant to erect buildings and install equipment.

The B. F. Goodrich Co. has acquired the business of the Brunswick Tire Co. of Muskegon. The tire production of the latter company will be transferred to the Akron plant of the Goodrich company.

A new cotton boll weevil laboratory has been established by the Federal Department of Agriculture at Florence, S. C., in co-operation with the United States Bureau of Entomology and the South Carolina Experiment Station at that place. Dr. E. N. Winters will be in charge.

The Alexander Smith & Sons Carpet Co. has distributed more than $441,000 among 6,742 employees. This was the twenty-fifth semi-annual distribution of profits in which the employees have shared.

H. G. C. Dunham has acquired the interests of his former partner in the business of Macy & Dunham, for years prominent dealers in linseed oil in New York. The business will be continued under the name of Macy & Dunham.

Society Meetings During The Chemical Exposition

The Chemical Exposition this year is being held during the week immediately following the annual meeting of the American Chemical Society, as has been the custom in previous years. The A.C.S. will meet during the week of September 10th at St. Paul, and immediately after the close of the meeting, its members will entrain for New York in order to spend the week of the 17th at the Exposition. The usual meeting of the American Ceramic Society will be held in conjunction with the Exposition in the Grand Central Palace on September 19th, probably extending over several days. The annual banquet and election of the Salesmen's Association of the American Chemical Industry will also be held during the week of the Exposition, very probably at one of the Pershing Square group of hotels near the Grand Central Palace. The regular dinner during the Chemical Exposition of the American Institute of Chemical Engineers will be on Wednesday evening, September 19th at the Park Avenue Hotel, reservation for which should be sent to Dr. John C. Olsen, the Secretary, at 85 Livingston Street, Brooklyn, N. Y.

Facts and Figures That Influence Trade in Chemical Products

Market Conditions

Current Prices
Imports and Exports
The Trend of Business

More Confident Tone Underlies Market for Chemical Products

Fall Requirements Expected to Force Buying Very Soon—Spot Trading Improving Slowly

AS THE time draws nearer for the various consuming trades to take on supplies for fall needs, the market for chemicals is assuming a more stable level and sellers are less inclined to take the initiative by making prices more attractive. There are still stocks in the spot market which holders are anxious to move and spot trading is far from consistent, so that prices can not be expected to change from an easy to a strong position over night. There are indications, however, that many commodities are at low levels and distressed lots no doubt have been greatly reduced in volume.

The weighted index for the week shows a slight gain, following a period of steady price declines in preceding weeks. This is reflective of the feeling which is increasing in the market and bears out the contention of traders who say that the summer season of dullness has about run its course.

The feeling of firmness is added to by reports that many chemicals of foreign origin are commanding higher prices at home than in our markets and that spot prices here must eventually be superseded by those as dictated by replacement costs. The lessening of competition from foreign markets, if this condition continues, naturally is regarded as favorable to a firmer market for domestic products throughout the industrial range.

Price changes during the week were not important. Makers of tartaric acid reduced prices to bring them more in line with importer's quotations. Bleaching powder was weak for spot and prompt and a few other materials were subject to price concessions. But the list in general was steady and many items which had been weak and irregular in price, were firmly held and showed evidences of gaining part of their previous losses. Caustic potash met with very limited inquiry yet the quoted price was fully maintained. Some holdings of permanganate of potash were marked up in price. Prussiates are higher than they were 2 weeks ago. Export prices on caustic soda were firmer. It was also stated some business had been done in forward positions on some of the heavy chemicals and that inquiry for futures was beginning to appear from different industries.

The exchange situation was followed closely as declines in sterling and other foreign monies was felt to be against improvement in export business and also might cause lower prices at primary points abroad.

Bichromate of Potash Easy—Domestic Tartaric Acid Lower in Price—Permanganate of Potash Firmer—Arsenic Steady for Spot and Prompt—Caustic Potash Steady—Small Stocks of Calcium Chloride—Calcium Arsenate Dull and Nominal.

Acids

Acetic Acid—Raw materials are holding steady and while present demand for acid is light, the market is quotably unchanged. It is expected that large consumers will increase withdrawals shortly and thus reduce accumulated stocks in sellers hands. The decline in export business is shown by the returns for June which give exports as 70,532 lb. as against 1,032 081 lb. in June last year. Prices are held at $3.38@$3.63 for 28 per cent; $6.78@$7.13 for 56 per cent; $9.58@$9.83 for 80 per cent; $12 @$12.78 for glacial.

Boric Acid—Improved buying has been a feature and sellers report a better call for contract deliveries as well as a gain in new business. Export buying is not heavy but has shared in the general improvement. Prices are steady at 10@10½c. per lb. in sacks; 10½@11c. per lb. in bbl.; and 11@11½c. per lb. in kegs.

Citric Acid—Imports of citric acid in June were 112,115 lb. Small lots were more numerous but sellers say demand is still slow and values are none too steady. Reports were heard that sales were made at 50c. per lb. but asking prices were 50½@51c. per lb. Domestic makers are pretty well sold ahead and no change has been made in their quotation of 49c. per lb.

Lactic Acid—Buying is fairly steady and producers are not carrying much surplus. This is favorable for firm prices and reports of price concessions are not heard in connection with this acid. Prices are quoted at 4½@5c. per lb. for 22 per cent dark and 5½@6c. per lb. for 22 per cent light. For 44 per cent, dark, the quotation is 9½@10c. per lb. with the light at 11½@12c. per lb.

Muriatic Acid—While some producers are said to have accumulated stocks, they are not a weakening factor and if demand is as active as expected in the coming months these stocks will be needed to prevent shortage. Present buying is light but inquiry is better. Quotations are 90c.@$1 per 100 lb. for 18 deg.; $1@$1.10 per 100 lb. for 20 deg., and $1.75@$2 for 22 deg.

Oxalic Acid—Spot prices for this material have been steady around 12½c. per lb. with moderate sized lots moving freely. Domestic acid is offered at 12½c. per lb. at works and is finding a normal outlet.

Tartaric Acid — Domestic acid, for some time has been held above the levels quoted for imported. During the week makers revised prices downward and established a price of 36c. per lb. Many consumers are giving domestic acid the preference in spite of the price differential in favor of imported. Imported was offered during the period at 34c. per lb.

Potashes

Bichromate of Potash—A quiet week was reported with no large amounts changing hands. Export demand has been quiet and in June shipments to foreign countries amounted to 127,493 lb. as compared with 418,419 lb. in June last year. Prices in the local market have been easy and 10½c. per lb. was quoted in some quarters with 10¼c. per lb. asked by others.

Caustic Potash—While many members of the trade agreed that demand was light they stated that prices showed no tendency to ease off and on imported material the inside price was placed at 7½c. per lb. with a range upward according to grade and seller. Domestic material was steady at 9c. per lb. and upward on a quantity basis.

Chlorate of Potash—Holders of imported chlorate are reported to be having difficulty in moving stocks. This is due partly to quiet consuming demand and partly to reports that some spot holdings are not up to standard in color and other respects. Prices for imported vary with good grades at 7½c. per lb. Domestic chlorate is steady at 8½c. per lb. at works.

Permanganate of Potash — Some holders of spot material have advanced their asking prices to 18c. per lb. Reports that 17c. per lb. can be done are also heard and with other quotations at 17½c. per lb., it is evident that prices will remain a little irregular until weak offerings have been taken off the market. There is no interest in forward positions but importers say that ship-

ments continue to hold considerably above spot prices and this is gradually exerting a bullish effect on the market.

Prussiate of Potash—Red prussiate has been moving in a very restricted way. Prices for some time have been subject to private terms and spot holdings still are large enough to give buyers the advantage. Open quotations are repeated at 64@66c. per lb. Yellow prussiate has been firmer on spot in the past two weeks. A sale was reported at 33½c. per lb. during the week but 34c. per lb. is the general asking price. On shipments 29@30c. per lb. is quoted on imported selections.

Sodas

Acetate of Soda—The price at works is holding at 5½c. per lb. but there is little strength to quotations. Buyers are very reserved and when business develops competition is keen enough to give buyers the advantage. Sales have been made at 5c. per lb. and the latter figure is generally regarded as the present trading basis.

Bichromate of Soda—There were sales last week at 7¾c. per lb. and the market failed to hold the steady feeling which appeared in the previous week. In some quarters 8c. per lb. was quoted but buying orders were limited and many hold that market values will be irregular until a more sustained demand sets in. Producing costs are holding up and this is regarded as proof that bichromate is around its low level with prospects favoring higher levels for the fall period.

Caustic Soda—Better inquiry for export has given a firmer tone to f.a.s. quotations. A short time ago 3.10c. f.a.s. could have been done on outside brands but 3.15c. per lb. is now given as inside. For standard brands 3.25@3.30c. per lb. is quoted with intimations the outside figure will become general. Exports for the 12 months ending June 30 were 115,834,650 lb. as compared with 123,126,777 lb. in the preceding year. No complaints are heard regarding consumption in home industries and while reports were current recently that caustic might feel the weight of keen selling competition, this has not proved to be the case. Prices are holding at 3.16½c. per lb. for 76 per cent, carlots at works. Flake and ground are quoted at 3.60c. per lb. and upward according to package.

Cyanide of Soda—Exports in June were 920,830 lb. as against 17,418 lb. in June 1922. For the 12 months ending June exports were 3,291,859 lb. Exports for the preceding year were not separately listed so no comparison is possible. It is evident, however, that export buying in recent months has been unusually large which is noteworthy as imported cyanide has been selling in our market under the price of domestic. Another feature regarding June exports is that the value is given as $83,112 which is equivalent to a little over 9c. per lb. The local market showed no definite trend during the interval. Prices are given at 20@22½c. per lb. according to grade and seller.

"Chem. & Met." Weighted Index of Chemical Prices

Base = for 1913-14

This week	166.72
Last week	166.70
Aug., 1918	278.00
Aug., 1919	251.00
Aug., 1920	264.00
Aug., 1921	158.00
Aug., 1922	152.00

The advance in glycerine offset the moderate decline in crude cottonseed oil and the week's index number shows an increase of 2 points.

Nitrate of Soda—Many consumers are covered for some time ahead and with this buying power removed from the market there is very little activity. It is a little early for some consumers to enter the market and demand for spot goods is dull. There is nothing of importance from primary markets and with prices on an established basis there is nothing new from that angle. For spot goods the asking price is $2.45 per 100 lb. and the schedule for futures has remained at the levels previously announced.

Prussiate of Soda — The price for domestic prussiate has been fixed at 14½c. per lb. for August deliveries. Imported prussiate sold on spot at 14½c. per lb. and is firmer than in preceding weeks. Shipments from abroad are offered at 14c. per lb. Imports in June are officially placed at 69,453 lb. valued at $11,441.

Miscellaneous Chemicals

Arsenic—There was a sale at 9½c. per lb. for August delivery. This was a lot afloat which had been offered before at that price without finding a buyer. Spot arsenic is held at 9½c. per lb. and this figure holds good for both domestic and foreign makes. Producers offer domestic in large lots for future positions at 9c. per lb. but there is little if any interest in shipments and not much interest in spot. It is expected that contracts will soon be placed by large buyers but the spot market is not looked to for any activity.

Bleaching Powder—Price cutting was continued throughout the week and many holders showed that they were anxious to move stocks. Considerable speculation is heard regarding prices for future positions in view of the unexpected weakness which has developed for spot material. Prices are now given at 1.50@1.75c. per lb. but the inside figure is not general although most factors in the trade are said to have engaged in price cutting.

Calcium Arsenate—Very little interest was shown although reports of weevil damage to the cotton crop are numerous. Buyers and sellers seem far apart on prices as inquiries are concerned with prices below the general asking prices and buyers refrain from placing orders when they cannot secure supplies around their views. No definite market price exists and 12c. per lb. is said to be fairly representative of the market.

Calcium Chloride — Domestic producers reported the market as firm, the output in some directions being sold up. Prices, however, were nominally unchanged at $21 per ton, f.o.b. works, or $24.20 per ton, f.o.b. New York, carload basis. On the granular $27 was asked, f.o.b. works, and $30.20 per ton, f.o.b. New York. Demand has been good, particularly for the granular, which is used extensively in road maintenance operations. Imported material was more or less nominal, last sales passing at moderate concessions from the prices asked on the domestic.

Tin Oxide—With little movement in prices for tin the market for tin oxide held at 45c. per lb. Business was confined to small lots only. The metal closed the week at 38@38½c. per lb. for Straits.

Copper Sulphate—Stocks of imported are said to be rather heavy with not much chance of moving them. Prices are little better than nominal with spot around 5c. per lb. and shipments at 4½c. per lb. Domestic is quiet with prices at 5.25@5.35c. per lb.

Barium Chloride—Importers are quoting on a basis of $80 per ton for shipment and report the market as steady. Barium carbonate is in fair demand at $66 per ton works and spot material has been held at $75 per ton.

Alcohol

Improvement was reported in the volume of business put through in the market for denatured alcohol and a steady undertone prevailed in all quarters. No price changes were announced by leading producers. Formula No. 1, special, 190 proof, was offered on the basis of 38c. per gal., in drums, and 44c. per gal., in bbl. Regular formula No. 1, 188 proof, settled at 39c. per gal., in drums, and 45c. per gal., in bbl. The inquiry for ethyl spirits was along routine lines only, but prices ruled steady, the U.S.P. grade, 190 proof, holding at $4.75 per gal., in bbl. There was no change in the position of methanol.

Complaint Against Shellac Company

The American Shellac Company, Inc., of New York City, a manufacturer of paints, varnishes, shellac and substitutes for shellac, was yesterday charged in a complaint issued by the Federal Trade Commission, with using unfair methods of competition, in that it brands and advertises certain of its products as "white shellac" and "orange shellac," without indicating that the varnish is not wholly composed of pure shellac gum. These two products, the complaint states, are composed of from 60 to 80 per cent shellac gum and from 40 to 20 per cent of other gums, substitutes for shellac gum, cut in alcohol.

Coal-Tar Products

Better Inquiry for Benzene—Pyridine Higher on Scanty Holdings—Spot Phenol Unsettled; Futures Easy

MODERATE improvement was reported in call for benzene from consumers situated outside of the motor fuel field. Bids were around for fairly large quantities for last-quarter delivery, but the ideas of buyers were below the market and so far as some of the largest handlers were concerned they refused to come down in their views. On contract, bulk basis, it would have been possible to obtain the 90 per cent grade at 23c. per gal., f.o.b. works, with the customary premium obtaining on the pure. Export inquiry was in evidence, some of this originating on the Continent. Foreign trade in coal-tar products for the fiscal year ending with June 30, according to the Department of Commerce, reached the total of $10,171,318, which compares with $6,686,441 for the corresponding period a year ago. Traders feel confident that export business will continue to improve because of the political developments in Europe.

A firm situation prevails in pyridine. Domestic producers appear to be well sold up and there is little liklihood that the output in this country will be augmented until the end of September. In the mean time supplies abroad are in firm hands and cables received here in the past week again reported a higher market. Cresylic acid on spot was irregular, so far as prices go, and it was quite evident that supplies are coming on the market in a larger way. Phenol did not change much one way or the other and prices named on spot covered a rather wide range. Phenol for shipment was wholly nominal, with some producers more anxious for business, intimating that long-time contracts might be entered into at concessions. Salicylates closed unchanged, with the undertone barely steady, notwithstanding the recent decline in prices. Steady prices were reported on solvent naphtha. Xylene was offered more freely.

Anthracene — Foreign material has come on the market of late, but this failed to bring out any change in sentiment. On the 80 per cent material domestic producers quote 75@80c. per lb., contract basis. The imported settled nominally around 65@70c. per lb.

Aniline Oil and Salt — Exports of aniline oil and salt for the twelve months ending with June 30 amounted to 512,322 pounds, valued at $90,923. The market for aniline oil was quotably unchanged at 16c. per lb., immediate shipment from works. On the salt producers held out for 23@24c. per lb.

Beta-Naphthol — First-hands were asking from 22@23c. per lb. for spot goods. On shipment from works 20c. could have been done. Demand was quiet and the undertone barely steady.

Benzene—Offerings were not pressing for sale and in several directions the undertone was somewhat firmer. Inquiry was reported for benzene for shipment, but the ideas of buyers were several cents below the market. Quotations heard on the 90 per cent material range from 23@25c. per gal., tank cars, f.o.b. works, the inside figure obtaining on round-lots for shipment over a longer period. On the pure prices ranged from 25@27c. per gal, tank cars, f.o.b. works. Exports of benzene for the year ending with June 30 amounted to 78,727,250 lb., valued at $2,715,609, as against 55,179,363 lb., valued at $1,978,776 for the corresponding period a year ago.

Cresylic Acid — The market was a wholly nominal affair as regards prices, keen competition for business resulting in concessions. On the 97 per cent grade there were sellers all the way from 85@95c. per gal. Dark material, 95 per cent, changed hands below 80c.

Napthalene—Demand was slow and prices unsettled. Flake on spot settled at 6¾@7¼c. per lb., as to quantity and seller. Ball napthalene was inactive and prices were wholly nominal. Crude, according to advices from abroad, underwent little change. There were sellers in the leading British markets at £7@£12 per ton, works, the price depending upon the quality.

Pyridine—The offerings of pyridine were scanty and prices were little more than nominal. During the past week some small lots of foreign material changed hands around $4.50 per gal. At the close there was talk of a $5 market. Imported pyridine for shipment was offered at $4 per gal. Domestic material is sold up and producers say that they are not in a position to quote on nearby material.

Phenol—U.S.P. phenol on spot was traded in at prices ranging from 30@35c. per lb. Demand was confined almost wholly to small parcels for immediate and nearby delivery. September delivery 28c. was asked. On forward material the market was wholly nominal, there being talk of sellers at less than 25c. per lb. Larger consumers showed no buying interest in distant deliveries, believing that enough new production will soon come on the market to establish prices on a "reasonable" trading level.

Salicylic Acid—The recent reduction in prices brought out a few scattered orders. Competition continues keen and the undertone at the close was barely steady. U.S.P. acid was available for immediate shipment at 35c. per lb.

Xylene—Pure xylol was offered a little more freely on spot and prices named ranged from 65@70c. per gal. The commercial grade, in drums, f.o.b. works, held around 34c. per gal., forward delivery.

Canadian Newsprint Mills Booming Production

The production of newsprint in Canada during the first six months of 1923 has reached a total hitherto unapproached for any similar period. Up to the end of June Canadian mills manufactured 619,802 tons of newsprint paper, which represents a daily average production of 3,937 tons, or about 470 tons more than the daily average throughout 1922. The increase is due largely to the addition of new machines to the productive capacity of the mills, but also reflects an increased efficiency of operation and the speeding up of existing machines.

A comparison of the production figures for the first half of this year with those for the corresponding periods of previous years shows that production was 20 per cent greater than in 1922; 66 per cent greater than in 1921, and 39 per cent greater than in 1920. The production figures for the years from 1920 are as follows: 1923, 619,802 tons; 1922, 516,506 tons; 1921, 373,988 tons; 1920, 443,512 tons.

Financial Notes

The American Chicle Co. has called for redemption its 5-year 6 per cent notes to the amount of $171,000.

The New Jersey Zinc Co. reports for quarter ended June 30, net income after depreciation, depletion, etc., of $2,077,010, equal to 4.56 per cent on the $45,466,400 capital stock outstanding, as compared with $1,597,161, or 3.51 per cent, in the corresponding quarter a year ago.

The United States Food Products Co. has adjusted its income tax account with the government and plans for reorganization of the company will be carried out at once. These plans had been held up pending settlement of the income tax dispute.

The Ohio Leather Co., which was reorganized early this year, shows net earnings of $50,164 for the second quarter of the year.

The Mathieson Alkali Works for the six months ended June 30, reports operating profit of $1,049,667. After

The Columbian Carbon Co., shows net income of $1,161,432 for the quarter ended June 30. This is equivalent to $2.88 a share on the no par stock outstanding.

The report of the American Hide & Leather Company for the quarter ended June 30 shows a deficit of $189,134 after interest and depreciation, against a deficit of $12,204 in the same quarter a year ago.

The Durham Hosiery Mills Co. has declared its regular quarterly dividend of $1.75 on the preferred stock.

Vegetable Oils and Fats

Cottonseed Reflects Crop Conditions—Flaxseed Forecast Favorable—Palm Declines—Tallow Higher

SENTIMENT in the market for vegetable oils was very much mixed, but no important price movement took place. More interest was reported in futures. Cottonseed oil prices moved upwards early in the week on dry weather in Texas, but later the news of moderate rains soon brought out selling. The feature in linseed oil was the second forecast of the season on flaxseed indicating favorable conditions and a higher yield per acre. Palm oils were lower. Crushers announced a reduction in castor oil. Olive foots closed higher, while tallow also scored an advance.

Cottonseed Oil—The spell of hot dry weather in Texas caused shorts to run to cover and this steadied the option market over the first-half of the week. As soon as the weather reports became more encouraging prices eased off. In other words, the market during the past week was governed almost entirely by the weather map. Trading in cash products was inactive and prices were unsettled. The lard market acted better on smaller receipts of hogs. Cottonseed oil futures continued at a sharp discount. The market for refined oil, covering the new crop positions, was actually on a hedging basis, but refiners were not active. Prime summer yellow on spot, in bbl., closed at 10½@10¾c. per lb. Bleachable for prompt shipment from Texas settled at 8½c. per lb., buyers' tanks. On nearby bleachable, f.o.b. New York, the market closed around 9½c. per lb., buyers' tanks. Crude for immediate shipment from mills settled at 7¾c., with August at 7¼c. and September at 6¾c. October-November-December crude was offered at 6¼c. per lb., buyers' tanks, f.o.b. Texas. Lard compound was offered at 11¾@12c. per lb., carload lots, f.o.b. New York.

Linseed Oil—While prices underwent little change the undertone towards the close was easier. The crop report, issued on Tuesday, indicated a yield of 19,100,000 bu., which compares with 18,000,000 bu. a month ago. The condition was placed at 82.4 per cent of normal, which compares with 85 per cent a month ago. The yield per acre was estimated at 8.3 bu., contrasted with 7.9 bu. a month ago. The report tends to strengthen the belief that this country will produce a good crop, considering the acreage sown. News from the Argentine regarding the supply of old crop seed yet on hand is conflicting, but the action of the Buenos Aires market led operators with bearish views to feel a little more confident. Argentine shipments of flaxseed from January 1 to August 4 amounted to 37,756,000 bu., of which total 19,272,000 bu. were shipped to the United States. Argentine seed was offered at a shade under $2 per bu., c.i.f. New York. At Buenos Aires the September option settled around $1.75⅛ per bu. Indian offerings increased. Shipments of Indian seed to all countries from January 1 to date amounted to approximately 10,000,000 bu., which compares with 7,500,000 bu. for the same period a year ago. Addition parcels of resale oil came out last week and one lot of 40,000 gal. sold for August delivery at 88c. per gal., cooperage basis. Crushers quote August oil, in cooperage, at 98c. per gal., with September at 93c., October at 89c. and November-December at 85c. On early next year contracts 83c. could have been done. The uncertainty surrounding the cake market tends to steady oil futures. Imports of linseed oil for the year ending June 30 amounted to 56,763,728 lb., against 168,705,383 lb. the year previous.

China Wood Oil—Spot oil held around 23½c. per lb. Demand was quiet, but steady cables from China supported the market. On futures several importers refused to shade 24½c. per lb., cooperage basis, f.o.b. New York.

Coconut Oil—Scattered tanks of Ceylon type oil changed hands at 7½c. per lb., August shipment from the Pacific coast. Large consumers placed no additional business. Ceylon type oil for shipment from New York closed at 8c. asked, sellers' tanks. Copra was offered at 4½c., c.i.f. coast, forward shipment from Manila.

Corn Oil—There were offerings of crude corn oil at 7½c. per lb., f.o.b. point of production, a decline of ¼c.

Castor Oil—Producers lowered prices ½c. per lb., establishing the market for the commercial grade at 13c. per lb., barrels included. Increased holdings of castor beans brought out the reduction.

Olive Oil Foots—Inquiry developed for prime green foots and the market was raised to 8¾c. per lb., immediate delivery.

Palm Oils—Lower exchange, together with freer offerings from abroad, resulted in a general reduction in prices. Lagos for shipment closed at 6⅝c., with Niger at 6¾c. Some buying interest developed after the decline. Imports of palm oil for the fiscal year ending with June amounted to 118,815,952 lb., as against 39,159,322 lb. a year ago.

Soya Bean Oil—The market was dull. Crude was offered at 8½c., coast, sellers' tanks, duty paid, and at 8⅝c. per lb., f.o.b. New York.

Menhaden Oil—Demand was dull and the price of 40c. per gal. for crude, f.o.b. factory, was barely steady. Fishing returns were fair last week.

Tallow, etc.—Several cars of extra tallow sold to a local soaper at 6¼c. delivered, equal to 6⅜c. ex plant, an advance of ¼c. for the week. Oleo stearine sold at 10c., but later there were sellers at 9⅞c. No. 1 oleo oil was offered at 11¼c. per lb., bbl. included.

Miscellaneous Materials

Barytes—Reports from the west indicate that business is satisfactory and prices steady. Producers quote the crude at $8@$10 per ton, with the white fliated at $28@$29 per ton, carload lots, f.o.b. St. Louis.

Dry Colors—The recent weakness in prussiates brought out an easier situation in iron blues. There were offerings of Prussian blue at 53c. per lb., with intimation that this figure could be shaded on a round-lot. English vermilion was irregular, reflecting recent pressure in quicksilver. Carbon black was offered a little more freely.

Casein—There were offerings of imported casein at 14@15c. per lb. Demand was routine only and some selling pressure was in evidence. On the domestic first-hands quote 16c. per pound.

Glycerine—Refiners announced an advance of 1c. per lb. in the price of chemically pure glycerine. Continued strength in crude, due, in part, to the restricted production, resulted in the firmer market for the C.P. Refiners now quote 17c. per lb., in drums, carload lots, and 17½c. per lb., less than carload lots. Dynamite glycerine sold recently at 15½c. per lb., but late last week bids at 16c. failed to interest sellers. Soaplye crude, basis 80 per cent, settled at 11¼c. per lb., loose, with saponification at 12¾@13c. per lb. Imports of glycerine (crude) for the fiscal year ending with June 30 amounted to 13,447,510 lb., which compares with 2,091,117 lb. a year ago.

Naval Stores—The market was a quiet affair and prices were a shade lower. Spirits of turpentine settled at 93½c. per gal., immediate delivery. In rosins the lower grades held at $5.75@$5.80 per bbl.

Shellac — Easier exchange and unsettled primary markets resulted in freer offerings here. Closing prices were slightly lower. T.N. settled at 53@54c. per lb. Bleached, bonedry, was available at 64c. per lb. Superfine orange held at 50@60c. Imports for the year ending June 30 amounted to 32,805,904 lb., against 30,767,666 lb. a year ago.

Lithopone—Producers reported prices steady on the carload basis of 7c. per lb., in bags, nearby positions.

Lead Pigments—Pig lead was not so firm as a week ago, but the official price held at 6.50c. per lb., New York. Corroders regarded the market for pigments as steady, with business up to normal for this season of the year. Standard dry white lead, in casks, 9¼c. per lb.; sulphate, 8¾c. per lb.; red lead, dry, 10¼c. per lb.; litharge, 10⅜@10½c. per lb., and orange mineral, domestic, 13.90c. per lb.

Zinc Oxide — First-hands reported the market as unchanged, with the undertone steady. Business was described as fair. Lead free, American process, carload basis, 8c. per lb.; leaded grades, 7@7¼c. per lb. French process, red seal, 9⅜c.; green seal, 10⅜c. and white seal, 12c. per lb.

Imports at the Port of New York

Aug. 3 to Aug. 8

ACIDS—Cresylic—89 dr., Liverpool, Order; 58 dr., Liverpool, Order. **Oxalic**—15 pkg., Rotterdam, R. W. Greeff & Co.

AMMONIUM BROMIDE—20 cs., Hamburg, Order.

AMMONIUM CHLORIDE—30 csk., Hamburg, Hans Hinrichs Chem. Co.

AMMONIUM CARBONATE — 10 csk., Liverpool J. Turner & Co.; 10 csk., Liverpool, Brown Bros. & Co.

AMMONIUM PERCHLORATE—976 cs., Genoa, New York Trust Co.

ANTHRACENE — 143 csk., Rotterdam, Lunham & Moore.

ALCOHOL — 2 dr. butyl, Havre, De Mattia Chemical Co.

ANTIMONY SULPHURET — 15 csk., Southampton, F. B. Vandegrift & Co.; 21 csk., London, F. B. Vandegrift & Co.

ARSENIC—86 bbl., Tampico, American Metal Co.

ASBESTOS—540 bg., Southampton, W. D. Crumpton & Co.

BRONZE POWDER—9 cs., Hamburg, M. J. Corbett & Co.; 12 cs., Hamburg, Stone-Gross Co; 2 cs., Hamburg, Order.

BARYTES—10 bbl., Hamburg, A. Hurst & Co.

CASEIN—100 bg., Southampton, N. Y. Trust Co.; 140 sk., Wanganwi, Order; 280 bg., Wanganwi, Bankers Trust Co.; 40 bbl., Southampton, N. Y. Trust Co.; 151 bg., Hamburg, Artificial Horn Co.; 196 bg., Hamburg, Order.

CALCIUM CHLORIDE—93 dr., Hamburg, Bank of America.

CHALK—25 csk. precipitated, Liverpool, Anderson, Hillier & Co.; 1,500 bg., Antwerp, Bankers Trust Co.; 1,210 bg., Antwerp, Bankers Trust Co.

CHEMICALS—10 cs., Hamburg, Lehn & Fink; 53 bbl., Hamburg, Roessler & Hasslacher Chemical Co.; 45 csk., Hamburg, Chaplain & Bibbo; 412 csk., Rotterdam, Hummel & Robinson; 136 csk., Rotterdam, Interstate Chemical Co.; 220 cs., Rotterdam, Order; 499 bg., Glasgow, Brown Bros. & Co.; 560 bg., Glasgow, Bankers Trust Co.; 6 cs., Hamburg, Merck & Co.; 17 cs., Hamburg, Order.

CLAY—210 sk. burnt, Liverpool, H. A. Robinson & Co.

COAL-TAR PRODUCTS—6 csk., Hamburg, Franklin Import & Export Co.

COLORS—4 bbl. aniline, Genoa, Order; 12 csk aniline, Genoa, American Exchange Nat'l Bank; 15 csk. aniline, Genoa, Irving Bank-Col. Trust Co.; 4 csk. do., Genoa, Ladenburg, Thalmann & Co.; 20 csk. do., Genoa, Order; 10 csk. dry, Southampton, Order; 5 csk. aniline, Havre, W. F. Sykes & Co.; 31 cs. do., Havre, Ciba Co; 59 csk aniline, Antwerp, National Aniline & Chemical Co.; 49 bbl., Hamburg, Fuchs & Lang; 10 cs. ultramarine blue, Antwerp, Reichard-Coulston, Inc.; 86 bbl. and 150 bg. earth, Leghorn, Reichard-Coulston, Inc.; 2 bbl. aniline, Hamburg, Fezandie & Sperrie; 10 bbl. do., Hamburg, Sigmund Ullmann; 10 csk. aniline, Hamburg, F. E. Atteaux & Co.; 5 csk. alizarine, Rotterdam, H. A. Metz & Co.; 19 bbl. earth, Hamburg, A. Hurst & Co.; 2 csk. aniline, Havre, Carbic Color & Chemical Co.; 10 csk., Havre, Order; 19 csk., Havre, Sandoz Chemical Works.

COPRA—438 bg., Kingston, United Fruit Co; 200 bg., Puerto Cortez, Atlantic Navigation Co.; 460 bg. Port Antonio, Franklin Baker Co.

CREAM TARTAR—50 csk., Rotterdam, Order.

DIVI-DIVI—1,037 bg., Curacao, Selma Merc. Corp.; 522 bg., Pampatar, Eggers & Heinlein; 400 bg. Pampatar, Goldsmith & Co.

FUSEL OIL—6 dr., Dunkirk, Order; 30 bbl. Danzig, Order.

GLYCERINE—25 dr., Auckland, Marx & Rawolle.

GLAUBER SALT—116 csk., Hamburg.

GAMBIER—565 cs., Singapore, Order.

GUMS — 100 cs. arabic, Port Sudan, Anglo-Egyptian Bank; 420 bg. arabic, Port Sudan, Order; 592 cs. kauri, Auckland, J. D. Lewis; 452 cs. kauri, Auckland, A. Klipstein & Co.; 235 cs. kauri, Auckland, L. C. Gillespie & Sons; 510 pkg. kauri, Auckland, Order; 205 cs damar and 50 bg. copal, Singapore, Baring Bros. & Co.; 150 bg. copal, Singapore, Standard Bank of South Africa; 150 bg. copal, Singapore, Chemical National Bank; 490 bg. damar and 444 pkg. copal, Singapore, Kidder-Peabody & Co.; 205 bg. copal, Antwerp, Schall & Co.; 232 bg. copal, Antwerp, Chemical National Bank; 60 csk. aniline, Antwerp, Geigy Co.; 16 bg. copal, Antwerp, Order.

HEXAMETHYLENE—15 cs., Hamburg, Fidelity Int'l Trust Co.

IRON OXIDE—10 csk., Liverpool, C. B. Crystal Co.; 28 csk., Liverpool, J. A. McNulty; 24 csk., Liverpool, Reichard, Coulston, Inc.; 20 csk., Liverpool, Order; 74 cs., Liverpool, C. B. Chrystal & Co.; 24 csk., Liverpool, E. M. & F. Waldo.

MINERAL WHITE—1,200 bg., Liverpool, Hammill & Gillespie.

MYROBALANS—4,017 bg., Vizagapatem, British Bank of South America; 12,000 pkt., Calcutta, National City Bank; 1,990 pkg., Calcutta, Order; 1,000 bg., Liverpool, Endicott, Johnson Corp.

MAGNESITE—5,642 bg. lump, Madras, Order.

MAGNESIUM—22 csk. sulphate, Liverpool, A. Klipstein & Co.; 149 dr. chloride, Hamburg, Order; 1,000 bg. calcined, Rotterdam, Innis, Speiden & Co.; 70 dr. chloride, Hamburg, Innis, Speiden & Co.; 366 dr. chloride, Hamburg, Speiden-Whitfield & Co.

MANGANESE—46 csk., Hamburg, Order.

OCHRE—108 csk., Marseilles, Reichard-Coulston, Inc.

OILS—China Wood—585 csk., Shanghai, Standard Bank of South Africa. **Linseed**—144 dr., Rotterdam, W. Van Doorn. **Palm**—156 csk., Hamburg, African & Eastern Trading Co.; 40 csk., Liverpool, Order. **Palm Kernel**—36 csk., Liverpool, Order. **Seal**—140 tons, St. Johns, Bowring & Co.; 154 tons (bulk) and 150 csk., St. Johns, Cook & Swan Co.; 594 tons, Harstad (Norway), Order. **Sesame**—250 bbl., Marseilles, Order.

OIL SEEDS—Castor—26,967 bg., Cocanada, Order; 298 bg., Madras, Order. **Linseed**—16,240 bg., San Nicolas, Order; 31,550 bg. and 2,155,321 kilos (bulk), Buenos Aires, Order; 4,213 bg., Calcutta, Order.

OPIUM—20 cs., Constantinople, Order.

PLUMBAGO—150 bbl., Colombo, Order; 100 bbl., Colombo, H. W. Peabody & Co.; 549 bbl., Colombo, H. P. Winter & Co.; 200 bbl., Colombo, Order.

PARIS GREEN—406 kegs, Belawan, Nitrate Agencies, Ltd.

POTASSIUM SALTS—420 bbl. chloride, Hamburg, Roessler & Hasslacher Chemical Co.; 1,000 bg. muriate, Hamburg, Potash Importing Corp. of Am.; 134 csk. alum, Hamburg, Order; 2,000 bg. sulphate, Hamburg, Potash Importing Corp. of Am.; 6,000 bg. muriate, Hamburg, Order; 1,815 tons manure salt (bulk), Hamburg, Order; 3,000 bbl. chlorate, Hamburg, Order; 40 dr. permanganate, Rotterdam, Jungmann & Co.; 20 csk. yellow prussiate, Copenhagen, Superfos Co.; 4,978 bg. sulphate and 12,996 bg. manure salt, Hamburg, Potash Importing Corp. of Am.

QUEBRACHO—43,532 bg., Buenos Aires, Tannin Corp.; 22,252 bg., Buenos Aires, International Products Co.; 6,506 bg., Buenos Aires, Fourth Atlantic Nat'l Bank of Boston.

QUICKSILVER—50 flasks, Genoa, Order; 30 flasks, Tampico, Haas Bros.; 200 flasks, Leghorn, Order.

RHODAMINE — 4 csk., Hamburg, National City Bank.

SAL AMMONIAC—41 csk., Hamburg, Innis, Speiden & Co.; 16 csk., Hamburg, Order.

SHELLAC—100 bg., Calcutta, London & Liverpool Bank of Commerce; 100 bg. and 240 cs., Calcutta, Brown Bros. & Co.; 850 bg., Calcutta, Chase National Bank; 50 bg., Calcutta, Irving Bank-Col. Trust Co.; 1,175 bg. refuse lac, Calcutta, Bank of the Manhattan Co.; 1,690 bg., 361 bg. seedlac, 111 bg. button and 2 cs. garnet, Calcutta, Order.

SODIUM SALTS — 15 csk. carbonate, Liverpool, Brown Bros. & Co.; 250 cs. cyanide, Havre, J. Munroe & Co.; 84 dr. sulphite, Hamburg, C. S. Grant & Co.; 42,945 bg. nitrate, Iquique, Wessel, Duval & Co.; 77,983 bg. nitrate, Junin, Wessel, Duval & Co.; 224 cs. cyanide, Marseilles, Asia Banking Corp.

SPAR—500,000 kilos heavy, Bremen, Ore & Chemical Corp.

STARCH—250 bbl. potato, Rotterdam, A. Hoffman & Co.; 250 bbl. do., Rotterdam, J. Wertheimer & Sons.

TALC—200 bg., Genoa, Kountze Bros.; 3,000 bg., Genoa, Ital. Discount & Trust Co.

TARTAR—420 bg., Buenos Aires, Royal Baking Powder Co.; 359 bg., Rotterdam, C. Pfizer & Co.

UMBER—2,610 bg. Larnaca, Reichard-Coulston, Inc.

WAXES—5 bg. bees, Puerto Plata, Cordillera Commercial Co.; 11 pkg. do., Monte Cristi, Order; 664 bg. bees, Rotterdam, Strohmeyer & Arpe Co.

WHITING—1,000 bg., Antwerp, Bankers Trust Co.

ZINC RESINATE—10 csk., Liverpool, H. Firlan.

Latest Quotations on Industrial Stocks

	Last Week	This Week
Air Reduction	*63	*63⅞
Allied Chem. & Dye	64	62½
Allied Chem. & Dye pfd	107	107½
Am. Ag. Chem.	12	12½
Am. Ag. Chem. pfd	30⅜	32
American Cotton Oil	5⅜	5⅜
American Cotton Oil pfd	16¼	17½
Am. Drug Synd	4⅛	4½
Am. Linseed Co.	18	*19
Am. Linseed pfd	40	39
Am. Smelting & Refining Co.	54¼	57
Am. Smelting & Refining pfd.	95¼	96
Archer-Daniels Mid. Co., w.i.	25	26
Archer-Daniels Mid. Co. pfd.	92	93
Atlas Powder (new)	51¼	53¾
Casein Co. of Am.	*60	*62
Certain-Teed Products	*26	*25
Commercial Solvents "A"	*32	*32
Corn Products	119¼	121¾
Corn Products pfd	*118	120
Davison Chem.	27⅛	29⅜
Dow Chem. Co.	*42	*42
Du Pont de Nemours	115¼	117½
Du Pont de Nemours db	83	83
Freeport-Texas Sulphur	10¾	10⅜
Glidden Co.	8	*8¾
Grasselli Chem.	*132	*132
Grasselli Chem. pfd	*105	*105
Hercules Powder	*105	*103
Hercules Powder pfd	*102	*104
Heyden Chem.	1⅜	1⅜
Int'l Ag. Chem. Co.	2⅛	2⅛
Int'l Ag. Chem. pfd	6⅛	7⅞
Int'l Nickel	12⅛	11⅞
Int'l Nickel pfd	79¼	78
Int'l Salt	*83	*77
Mathieson Alkali	38⅛	41⅞
Merck & Co.	*83	82
National Lead	112	113⅜
National Lead pfd	*110¼	112⅛
New Jersey Zinc	*154	150
Parke, Davis & Co.	79	*79
Pennsylvania Salt	*81	*81
Procter & Gamble	*128	128
Sherwin-Williams	28⅛	28⅞
Sherwin-Williams pfd.	*101	102
Tenn. Copper & Chem.	8⅞	9⅛
Texas Gulf Sulphur	57	57⅛
Union Carbide	54	54⅜
United Drug	77	79⅛
U. S. Industrial Alcohol	46⅜	47
U. S. Industrial Alcohol pfd.	*100	*100
Va.-Car. Chem. Co.	9	8⅛
Va.-Car. Chem. pfd	24	22⅛

*Nominal. Other quotations based on last sale.

Paint Research Planned

The Institute of Paint and Varnish Research, Nineteenth and B Sts., N.W., Washington, D. C., has plans under way for the erection of a new 2-story laboratory, 35x70 ft., at 22d. St., and New York Ave., estimated to cost $50,000. H. A. Gardner is in charge. John M. Donn, 1147 Connecticut Ave., N.W., is architect.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetone, drums	lb.	$0.25 – $0.25½
Acid, acetic, 20%, bbl.	100 lb.	3.38 – 3.50
Acetic, 56%, bbl.	100 lb.	6.75 – 7.00
Acetic, 80%, bbl.	100 lb.	9.58 – 9.83
Glacial, 99½%, bbl.	100 lb.	12.00 – 12.78
Acetic anhydride, 85%, dr.	lb.	.38 – ....
Boric, bbl.	lb.	.10½–
Citric, kegs	lb.	.49 – .52
Formic, 85%	lb.	.12 – .14
Gallic, tech.	lb.	.45 – .50
Hydrofluoric, 52%, carboys	lb.	.11 – .12
Lactic, 44%, tech., light, bbl.	lb.	.11½– .12
22% tech., light, bbl.	lb.	.05½– .06
Muriatic, 18° tanks	100 lb.	.90 – 1.00
Muriatic, 20°, tanks,	100 lb.	1.00 – 1.10
Nitric, 36°, carboys	lb.	.04½– .05
Nitric, 42°, carboys	lb.	.06 – .06½
Oleum, 20%, tanks	ton	18.50 – 19.00
Oxalic, crystals, bbl.	lb.	.12½– .12½
Phosphoric, 50% carboys	lb.	.07½– .08½
Pyrogallic, resublimed	lb.	1.50 – 1.60
Sulphuric, 60°, tanks	ton	11.00 – 12.00
Sulphuric, 60°, drums	ton	13.00 – 14.00
Sulphuric, 66°, tanks	ton	15.00 – 16.00
Sulphuric, 66° drums	ton	20.00 – 21.00
Tannic, U.S.P., bbl.	lb.	.65 – .70
Tannic, tech., bbl.	lb.	.45 – .50
Tartaric, imp., powd., bbl.	lb.	.34 – .34½
Tartaric, domestic, bbl.	lb.	.36 – ....
Tungstic, per lb.	lb.	1.10 – 1.20
Alcohol, butyl, drums, f.o.b. works	lb.	.26 – .28
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.78 – ....
Ethyl, 190 p'f. U.S.P., bbl.	gal.	4.75 – ....
Alcohol, methyl (see Methanol)		
Alcohol, denatured, 190 proof		
No. 1, special bbl.	gal.	.44 – ...
No. 1, 190 proof, special, dr.	gal.	.38 – ...
No. 1, 188 proof, bbl	gal.	.45 – ...
No. 1, 188 proof, dr	gal.	.39 – ...
No. 5, 188 proof, bbl.	gal.	.42 – ...
No 5, 188 proof, dr	gal.	.37 – ...
Alum, ammonia, lump, bbl.	lb.	.03½– .03¾
Potash, lump, bbl.	lb.	.03 – .04½
Chrome, lump, potash, bbl.	lb.	.06 – .07
Aluminum sulphate, com., bags	100 lb.	1.40 – 1.50
Iron free bags	lb.	2.40 – 2.50
Aqua ammonia, 26°, drums	lb.	.07 – .07½
Ammonia, anhydrous, cyl.	lb.	.30 – .30½
Ammonium carbonate, powd. casks, imported	lb.	.09½– .10
Ammonium carbonate, powd. domestic, bbl.	lb.	.13 – .14
Ammonium nitrate, tech., casks	lb.	.10 – .11
Amyl acetate tech., drums	gal.	4.50 – 4.75
Antimony Sulpuret, golden	lb.	.19 – .21
Arsenic, white, powd., bbl.	lb.	.09½– .10½
Arsenic, red, powd., kegs	lb.	.15 – .15½
Barium carbonate, bbl.	ton	65.00 – 70.00
Barium chloride, bbl.	ton	80.00 – 90.00
Barium dioxide, drums	lb.	.18 – .18½
Barium nitrate, casks		.08 – .08½
Blanc fixe, dry, bbl.	lb.	.04 – .04½
Bleaching powder, f.o.b. wks., drums	100 lb.	1.75 – ....
Spot N. Y. drums	100 lb.	2.00 – 2.20
Borax, bbl.	lb.	.05½– .05½
Bromine, cases	lb.	.29 – .31
Calcium acetate, bags	100 lb.	4.00 – 4.05
Calcium arsenate, dr.	lb.	.11½– .14½
Calcium carbide, drums	lb.	.05¼– .05½
Calcium chloride, fused, drums	ton	23.00 – 24.20
Gran. drums	ton	29.00 – 30.20
Calcium phosphate, mono, bbl.	lb.	.06½– .07
Camphor, cases	lb.	.86 – .88
Carbon bisulphide, drums	lb.	.07 – .07½
Carbon tetrachloride, drums	lb.	.09½– .10
Chalk, precip.—domestic, light, bbl.	lb.	.04½– .04½
Domestic, heavy, bbl.	lb.	.03½– .03½
Imported, light, bbl.	lb.	.04½– .05
Chlorine, liquid, tanks, wks.	lb.	.05½– .05½
Cylinders, 100 lb., wks	lb.	.06 – .06½
Cylinders, 100 lb., spot	lb.	.09 – ....
Chloroform, tech., drums	lb.	.35 – .38
Cobalt oxide, bbl.	lb.	2.10 – 2.25
Copperas, bulk, f.o.b. wks.	ton	19.00 – 20.00
Copper carbonate, bbl.	lb.	.18 – .19
Copper cyanide, drums	lb.	.47 – .50
Coppersulphate, dom., bbl.,	100 lb.	5.35 – ....
Imp. bbl.	100 lb.	4.50 – 4.75
Cream of tartar, bbl.	lb.	.25 – .26
Epsom salt, dom., tech., bbl.	100 lb.	1.75 – 2.00
Epsom salt imp., tech., bags	100 lb.	.90 – 1.00
Epsom salt, U.S.P., dom., bbl.	100 lb.	2.00 – 2.50
Ether, U.S.P., resale, dr.	lb.	.13 – .15
Ethyl acetate, 85%, drums	gal.	.80 – .81
Ethyl acetate, ether, 98% to 100%)	gal.	$0.95 – $1.00
Formaldehyde, 40%, bbl.	lb.	.14 – .14½
Fullers earth—imp., powd., net	ton	30.00 – 32.00
Fusel oil, ref., drums	gal.	–
Fusel oil, crude, drums	gal.	4.00 – 4.25
Glaubers salt, wks., bags	100 lb.	1.20 – 1.40
Glaubers salt, imp., bags	100 lb.	.90 – .95
Glycerine, c.p., drums extra	lb.	.17 – .17½
Glycerine, dynamite, drums	lb.	.16 – ....
Glycerine, crude 80%, loose	lb.	.11½– ....
Iron oxide, red, casks	lb.	.12 – .18
Lead:		
White, basic carbonate, dry, casks	lb.	.09½– .09½
White, basic sulphate, casks	lb.	.08½– .09
White, in oil, kegs	lb.	.11½– .11½
Red, dry, casks	lb.	.10½– .10½
Red, in oil, kegs	lb.	.13 – .14½
Lead acetate, white crys., bbl.	lb.	.14 – .14½
Brown, broken, casks	lb.	.13 – .13½
Lead arsenate, powd., bbl.	lb.	.20 – .21
Lime-Hydrated, bbl.	per ton	16.80 – 17.00
Lime, Lump, bbl	280 lb.	3.63 – 3.65
Litharge, comm., casks	lb.	.10½– .10½
Lithophone, bags	lb.	.07 – .07½
in bbl.	lb.	.07½– .07½
Magnesium carb., tech., bags	lb.	.08 – .08½
Methanol, 95%, bbl.	gal.	1.18 – 1.20
Methanol, 97%, bbl.	gal.	1.20 – 1.22
Methyl-acetone, t'ks.	gal.	1.15 – ....
Nickel salt, double, bbl.	lb.	.10½– ....
Nickel salts, single, bbl.	lb.	.11½– ....
Phosgene		.60 – .75
Phosphorus, red, cases	lb.	.... – ....
Phosphorus, yellow, cases	lb.	.35 – .40
Potassium bichromate, casks	lb.	.10½– .10½
Potassium bromide, gran., bbl.	lb.	.19 – .20
Potassium carbonate, 80-85%, calcined, casks	lb.	.06½– .06½
Potassium chlorate, powd.	lb.	.07 – .08½
Potassium cyanide, drums	lb.	.47 – .52
Potassium, first sorts, cask	lb.	.08 .08¼
Potassium hydroxide (caustic potash) drums	lb.	.07½– .09
Potassium iodide, cases	lb.	3.65 – 3.75
Potassium nitrate, bbl.	lb.	.06½– .07½
Potassium permanganate, drums	lb.	.17½– .18
Potassium prussiate, red, casks	lb.	.63 – .65
Potassium prussiate, yellow, casks	lb.	.33½– .34½
Salammoniac, white, gran., casks, imported	lb.	.05½– .06
Salammoniac, white, gran., bbl., domestic	lb	.07½– .07½
Gray, gran., casks	lb.	.08 – .09
Salsoda, bbl.	100 lb.	1.20 1.40
Salt cake (bulk)	ton	26.00 – 28.00
Soda ash, light, 58% flat, bags, contract	100 lb.	1.45 – 1.50
Soda ash, light, 58%, flat, bags, resale	100 lb.	1.70 – 1. 75
Soda ash, dense, bags, contract, basis 58%	100 lb.	1.51 – ....
Soda ash, dense, in bags, resale	100 lb.	1.85 – 1.90
Soda, caustic, 76%, solid, drums	100 lb.	3.16½– ....
Soda, caustic, ground and flake, contracts	100 lb.	3.60 – 3.85
Soda, caustic, ground and flake, resale	100 lb.	3.72½– ....
Sodium acetate, works, bags	lb.	.05½– .05¾
Sodium bicarbonate, bbl.	100 lb.	2.00 – 2.50
Sodium bichromate, casks	lb.	.07½– .08
Sodium bisulphate (niter cake)	ton	6.00 – 7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04½– .04½
Sodium chlorate, kegs	lb.	.06½– .07
Sodium chloride	long ton	12.00 – 13.00
Sodium cyanide, cases	lb.	.19 – .22½
Sodium fluoride, bbl.	lb.	$0.08½– $0.10½
Sodium hyposulphite, bbl.	lb.	.02½– .03
Sodium nitrite, casks	lb.	.07½– .07½
Sodium peroxide, powd., cases	lb.	.28 – .30
Sodium phosphate, dibasic, bbl.	lb.	.03½– .04
Sodium prussiate, yel. drums	lb.	.14 – .14½
Sodium salicylic, drums	lb.	.40 – .45
Sodium silicate (40°, drums)	100 lb.	.75 – 1.15
Sodium silicate (60°, drums)	100 lb.	1.75 – 2.00
Sodium sulphide, fused, 60-62% drums	lb.	.03 – .04
Sodium sulphite, crys., bbl.	lb.	.03½– .03¼
Strontium nitrate, powd., bbl.	lb.	.10 – .11
Sulphur chloride, yel drums	lb.	.04½– .05
Sulphur, crude	ton	18.00 – 20.00
At mine, bulk	ton	16.00 – 18.00
Sulphur, flour, bag	100 lb.	2.25 – 2.35
Sulphur, roll, bag	100 lb.	2.00 – 2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 – .08½
Tale—imported, bags	ton	30.00 – 40.00
Tale—domestic powd., bags	ton	18.00 – 25.00
Tin bichloride, bbl.	lb.	.11½– .12
Tin oxide, bbl.	lb.	.45 – ....
Tin crystals, bbl.	lb.	.30½– .31
Zinc carbonate, bags	lb.	.14 – .14½
Zinc chloride, gran, bbl.	lb.	.06½– .06½
Zinc cyanide, drums	lb.	.37 – .38
Zinc oxide, , lead free, bbl.	lb.	.08 – .08½
5% lead sulphate, bags	lb.	.07½– ....
10 to 35 % lead sulphate, bags	lb.	.07 – ....
French, red seal, bags	lb.	.09½– ....
French, green seal, bags	lb.	.10½– ....
French, white seal, bbl.	lb.	.12 – ....
Zinc sulphate, bbl.	100 lb.	2.50 – 3.00

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.60 – $0.70
Alpha-naphthol, ref., bbl.	lb.	.68 – .80
Alpha-naphthylamine, bbl.	lb.	.34 – .36
Aniline oil, drums	lb.	.16 – .16½
Aniline salts, bbl.	lb.	.23 – .24
Anthracene, 80%, drums	lb.	.75 – .80
Anthracene, 80%, imp., drums, duty paid	lb.	.65 – .70
Anthraquinone, 25%, paste, drums	lb.	.80 – .85
Benzaldehyde U.S.P., carboys	lb.	1.50 – ....
tech, drums	lb	75 ....
Benzene, pure, water-white, tanks and drums	gal.	.27 – .32
Benzene, 90%, tanks & drums	gal.	.25 – .30
Benzidine base, bbl.	lb.	.80 – .85
Benzidine sulphate, bbl.	lb.	.70 – .75
Benzoic acid, U.S.P., kegs	lb.	.75 – .80
Benzoate of soda, U.S.P., bbl.	lb.	.65 – .70
Benzyl chloride, 95-97%, ref., drums	lb.	.45 – ...
Benzyl chloride, tech., drums	lb.	.30 – .35
Beta-naphthol, tech., bbl.	lb.	.22 – .23
Beta-naphthylamine, tech.	lb.	.75 – .80
Cresol, U.S.P., drums	lb.	.25 – .29
Ortho-cresol, drums	lb.	.28 – .32
Cresylic acid, 97%, resale, drums	gal.	.85 – .95
95-97%, drums, resale	gal.	.80 – .85
Dichlorbenzene, drums	lb.	.06 – .08
Diethylaniline, drums	lb.	.50 – .60
Dimethylaniline, drums	lb.	.41 – .42
Dinitrobenzene, bbl.	lb.	.19 – .20
Dinitrochlorbenzene, bbl.	lb.	.21 – .22
Dinitronaphthalen, bbl.	lb.	.30 – .32
Dinitrophenol, bbl.	lb.	.35 – .40
Dinitrotoluen, bbl.	lb.	.20 – .22
Dip oil, 25%, drums	gal.	.25 – .30
Diphenylamine, bbl.	lb.	.50 – .52
H-acid, bbl.	lb.	.75 – .80
Meta-phenylenediamine, bbl.	lb.	1.00 – 1.05
Michlers ketone, bbl.	lb.	3.00 – 3.50
Monochlorbenzene, drums	lb.	.08 – .10
Monoethylaniline, drums	lb.	.95 – 1.10
Naphthalene, flake, bbl.	lb.	.07 – .07½
Naphthalene, balls, bbl.	lb.	.07½– .07¾
Naphthionate of soda, bbl.	lb.	.58 – .65
Naphthionic acid, crude, bbl.	lb.	.55 – .60
Nitrobenzene, drums	lb.	.10 – .12
Nitro-naphthalene, bbl.	lb.	.30 – .35
Nitro-toluene, drums	lb.	.13½– .14½
N-W acid, bbl.	lb.	1.25 – 1.30
Ortho-amidophenol, kegs	lb.	2.30 – 2.35
Ortho-dichlorbenzene, drums	lb.	.15 – .17
Ortho-nitrophenol, bbl.	lb.	1.20 – 1.30
Ortho-nitrotoluene, drums	lb.	.10 – .12
Ortho-toluidine, bbl.	lb.	.14 – .15
Para-amifiophenol, base, kegs	lb	1.35 – ....
Para-amifiophenol, HCl, kegs	lb.	1.55 – ....
Para-dichlorbenzene, bbl.	lb.	.17 – .20
Paranitroaniline, bbl.	lb.	.70 – .74
Para-nitrotoluene, bbl.	lb.	.60 – .65
Para-phenylenediamine, bbl.	lb.	1.45 – 1.50
Para-toluidine, bbl	lb.	.90 – .95
Phthalic anhydride, bbl.	lb.	.35 – .38
Phenol, U.S.P., dr.	lb.	.30 – .35
Picric acid, bbl.	lb.	.20 – .22
Pyridine, dom., drums	gal.	nominal

Pyridine, imp., drums	gal.	$4.50 –	.....
Resorcinol, tech., kegs	lb.	1.50 –	$1.60
Resorcinol, pure, kegs	lb.	2.25 –	.....
R-salt, bbl	lb.	.55 –	.60
Salicylic acid, tech., bbl	lb.	.32 –	.....
Salicylic acid, U.SP., bbl	lb.	.35 –	.....
Solvent napthha, water-white, tanks	gal.	.27 –	.....
Crude, tanks	gal.	.24 –	.....
Sulphanilic acid, crude, bbl	lb.	.18 –	.20
Thiocarbanilide, kegs	lb.	.35 –	.38
Tolidine, bbl	lb.	1.00 –	1.05
Toluidine, mixed, kegs	lb.	.30 –	.35
Toluene, tank cars	gal.	.30 –	.32
Toluene, drums	gal.	.34 –	.36
Xylidine drums	lb.	.50 –	.....
Xylene, pure, drums	gal.	.65 –	.70
Xylene, com., drums	gal.	.34 –	.....
Xylene, com., tanks	gal.	.29 –	.....

Naval Stores

Rosin B-D, bbl	280 lb.	$5.75 –	$5.80
Rosin E-I, bbl	280 lb.	5.95 –	.....
Rosin K-N, bbl	280 lb.	6.00 –	6.10
Rosin W.G.-W.W., bbl	280 lb.	6.25 –	7.25
Wood rosin, bbl	280 lb.	5.90 –	6.00
Turpentine, spirits of, bbl	gal.	.93½–	.....
Wood, steam dist., bbl	gal.	.75 –	.....
Wood, dest. dist., bbl	gal.	.60 –	.....
Pine tar pitch, bbl	200 lb.	..... –	6.00
Tar, kiln burned, bbl	500 lb.	..... –	12.00
Retort tar, bbl	500 lb.	..... –	11.50
Rosin oil, first run, bbl	gal.	.40 –	.....
Rosin oil, second run, bbl	gal.	.45 –	.....
Rosin oil, third run, bbl	gal.	.50 –	.....
Pine oil, steam dist	gal.	.70 –	.....
Pine oil, pure, dest. dist	gal.	.65 –	.....
Pine tar oil, ref	gal.	.48 –	.....
Pine tar oil, crude, tanks f.o.b. Jacksonville, Fla	gal.	.32 –	.32½
Pine tar oil, double ref., bbl	gal.	..... –	.75
Pine tar, ref., thin, bbl	gal.	..... –	.25
Pinewood creosote, ref., bbl	gal.	..... –	.52

Animal Oils and Fats

Degras, bbl	lb.	$0.03½–	$0.04½
Grease, yellow, bbl	lb.	.05½–	.06
Lard oil, Extra No. 1, bbl	gal.	.80 –	.85
Neatsfootoil 20 deg. bbl	gal.	1.28 –	1.30
No. 1, bbl	gal.	.92 –	.94
Oleo Stearine		.09½–	.....
Red oil, distilled, d.p. bbl	lb.	.08½–	.09½
Saponified, bbl	lb.	.08½–	.09¼
Tallow, extra, loose	lb.	.06½–	.....
Tallow oil, acidless, bbl	gal.	.86 –	.88

Vegetable Oils

Castor oil, No. 3, bbl	lb.	$0.13 –	.....
Castor oil, No. 1, bbl	lb.	.13½–	.....
Chinawood oil, bbl	lb.	.23½ –	.....
Coconut oil, Ceylon, bbl	lb.	.09 –	.09¼
Ceylon, tanks, N.Y	lb.	.08 –	.....
Coconut oil, Cochin, bbl	lb.	.09¼–	.09¾
Corn oil, crude, bbl	lb.	.09½–	.....
Crude, tanks, (f.o.b. mill)	lb.	.07½–	.....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.07½–	.....
Summer yellow, bbl	lb.	.10½–	.11
Winter yellow, bbl	lb.	.11½–	.12
Linseed oil, raw, car lots, bbl	gal.	.98 –	.....
Raw, tank cars (dom.)	gal.	.93 –	.....
Boiled, cars, bbl. (dom.)	gal.	1.00 –	.....
Olive oil, denatured, bbl	gal.	1.10 –	1.12
Sulphur, (foots) bbl	lb.	.08½–	.....
Palm, Lagos, casks	lb.	.06¼–	.....
Niger casks	lb.	.06½–	.....
Palm kernel, bbl	lb.	.08½–	.08¾
Peanut oil, crude, tanks (mill)	lb.	.10½–	.....
Peanut oil, refined, bbl	lb.	.13½–	.14
Per lla, bbl	lb.	.15½–	.15½
Rapeseed oil, refined, bbl	gal.	.77 –	.....
Rapeseed oil, blown, bbl	gal.	.82 –	.....
Sesame, bbl	lb.	.11¼ –	.11½
Soya bean (Manchurian), bbl	lb.	.10 –	.....
Tank, f.o.b. Pacific coast	lb.	.08½–	.....
Tank, (f.o.b. N.Y.)	lb.	.08¾ –	.09

Fish Oils

Cod, Newfoundland, bbl	gal.	$0.63 –	.....
Menhaden, light pressed, bbl	gal.	.65 –	.....
White bleached, bbl	gal.	.68 –	.....
Blown, bbl	gal.	.72 –	.....
Crude, tanks (f.o.b. factory)	gal.	.40 –	.....
Whale No. 1 crude, tanks, coast	fb.	..... –	.....
Winter, natural, bbl	gal.	.76 –	.78
Winter, bleached, bbl	gal.	.79 –	.80

Oil Cake and Meal

Coconut cake, bags	ton	$26.00 –	$28.00
Copra, sun dried, bags, (c.i.f.)	lb.	.04½–	.04¾
Sun dried Pacific coast	lb.	.04¼–	.04½
Cottonseed meal, f.o.b. mills	ton	36.00 –	.....
Linseed cake, bags	ton	35.00 –	36.00
Linseed meal, bags	ton	37.00 –	38.00

Dye & Tanning Materials

Albumen, blood, bbl	lb.	$0.45 –	$0.50
Albumen, egg, tech, kegs	lb.	1.00 –	1.05
Cochneal, bags	lb.	.33 –	.35
Cutch, Borneo, bales	lb.	.04½–	.04¾
Cutch, Rangoon, bales	lb.	.13 –	.13½
Dextrine, corn, bags	100 lb.	3.79 –	4.06
Dextrine, gum, bags	100 lb.	4.14 –	4.34
Divi-divi, bags	ton	38.00 –	39.00
Fustic, sticks	ton	30.00 –	35.00
Fustic, chips, bags	lb.	.04 –	.05
Logwood, sticks	ton	26.00 –	30.00
Logwood, chips, bags	lb.	.02½–	.03¼
Sumac, leaves, Sicily, bags	ton	78.00 –	80.00
Sumac, ground, bags	ton	$72.00 –	$75.00
Sumac, domestic, bags	ton	40.00 –	42.00
Starch, corn, bags	100 lb.	3.22 –	3.49
Tapioca flour, bags	lb.	.07 –	.07½

Extracts

Archil, cone., bbl	lb.	$0.18 –	$0.22
Chestnut, 25% tannin, tanks	lb.	.02 –	.03
Divi-divi, 25% tannin, bbl	lb.	.04 –	.05
Fustic, crystals, bbl	lb.	.20 –	.22
Fustic, liquid, 42°, bbl	lb.	.08 –	.09
Gambier, liq., 25% tannin, bbl	lb.	.08 –	.09
Hematine crys., bbl	lb.	.14 –	.18
Hemlock, 25% tannin, bbl	lb.	.03½–	.04
Hypernic, solid, drums	lb.	.24 –	.26
Hypernic, liquid, 51°, bbl	lb.	.09½–	.10½
Logwood, crys., bbl	lb.	.17 –	.18
Logwood, liq., 51°, bbl	lb.	.08½–	.09
Quebracho, solid, 65% tannin, bbl	lb.	.04½–	.05
Sumac, dom., 51°, bbl	lb.	.06¾–	.07½

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, spot	lb.	$0.17 –	$0.21
Lampblack, bbl	lb.	.12 –	.40
Mineral, bulk	ton	35.00 –	45.00
Blues–Bronze, bbl	lb.	.53 –	.55
Prussian, bbl	lb.	.53 –	.55
Ultramarine, bbl	lb.	.08 –	.35
Browns, Sienna, Ital., bbl	lb.	.06 –	.14
Sienna, Domestic, bbl	lb.	.03½–	.04
Umber, Turkey, bbl	lb.	.04 –	.04½
Greens–Chrome, C.P.Light, bbl	lb.	.32 –	.34
Chrome, commercial, bbl	lb.	.12 –	.12½
Paris, bulk	lb.	.25 –	.28
Reds, Carmine No. 40, tins	lb.	4.50 –	4.70
Oxide red, casks	lb.	.10 –	.14
Para toner, kegs	lb.	1.00 –	1.10
Vermilion, English, bbl	lb.	1.20 –	1.25
Yellow, Chrome, C.P. bbls	lb.	.20 –	.21
Ocher, French, casks	lb.	.02½–	.03

Waxes

Bayberry, bbl	lb.	$0.28 –	$0.29
Beeswax, crude, bags	lb.	.21½–	.22
Beeswax, refined, light, bags	lb.	.32 –	.34
Beeswax, pure white, cases	lb.	.40 –	.41
Candellila, bags	lb.	.20 –	.21
Carnauba, No. 1, bags	lb.	.41 –	.42
No. 2, North Country, bags	lb.	.23 –	.23½
No. 3, North Country, bags	lb.	.17½–	.18¼
Japan, cases	lb.	.15½–	.16
Montan, crude, bags	lb.	.04½–	.05
Paraffine, crude, match, 105-110 m.p.	lb.	.04 –	.04½
Crude, scale 124-126 m.p., bags	lb.	.02½–	.03
Ref., 118-120 m.p., bags	lb.	.03 –	.03½
Ref., 125 m.p., bags	lb.	.03½–	.03¾
Ref, 128-130 m.p., bags	lb.	.03½–	.03½
Ref., 133-135 m.p., bags	lb.	.04½–	.04¾
Ref., 135-137 m.p., bags	lb.	.05½–	.05½
Stearic acid, sgle pressed, bags	lb.	.12½–	.12¾
Double pressed, bags	lb.	.12¾–	.13
Triple pressed, bags	lb.	.14½–	.14½

Fertilizers

Ammonium sulphate, bulk, f.o.b. works	100 lb.	$3.20 –	$3.25
F.a.s. double bags	100 lb.	3.50 –	3.55
Blood, dried, bulk	unit	4.00 –	.....
Bone, raw, 3 and 50, ground	ton	27.00 –	30.00
Fish scrap, dom., dried, wks	unit	3.75 –	.....
Nitrate of soda, bags	100 lb.	2.45 –	2.52½
Tankage, high grade, f.o.b. Chicago	unit	3.60 –	3.75
Phosphate rock, f.o.b. mines, Florida pebble, 68-72%	ton	$4.00 –	$4.50
Tennessee, 78-80%	ton	8.00 –	8.25
Potassium muriate, 80%, bags	ton	34.55 –	.....
Potassium sulphate, bags basis 90%	ton	43.67 –	.....
Double manure salt	ton	25.72 –	.....
Kainit	ton	7.22 –	.....

Crude Rubber

Para—Upriver fine	lb.	$0.26½–	.....
Upriver coarse	lb.	.23½–	.....
Upriver caucho ball	lb.	.24 –	.....
Plantation—First latex crepe	lb.	.29 –	.29½
Ribbed smoked sheets	lb.	.29 –	.29¼
Brown crepe, thin, clean	lb.	.28 –	.....
Amber crepe No. 1	lb.	.28½–	.....

Gums

Copal, Congo, amber, bags	lb.	$0.12½–	$0.13½
East Indian, bold, bags	lb.	.23 –	.23½
Manila, pale, bags	lb.	.20 –	.20½
Pontinak, No. 1 bags	lb.	.20 –	.20½
Damar, Batavia, cases	lb.	.27½–	.28½
Singapore, No. 1, cases	lb.	.32 –	.33
Singapore, No. 2, cases	lb.	.23½–	.24
Kauri, No. 1, cases	lb	.68 –	.70
Ordinary chips, cases	lb.	.22½–	.23½
Manjak, Barbados, bags	lb.	.09 –	.09¼

Shellac

Shellac, orange fine, bags	lb.	$0.57 –	.....
Orange superfine, bags	lb.	.59 –	.....
A. C. garnet, bags	lb.	.58 –	.....
Bleached, bonedry	lb.	.64 –	.65
Bleached, fresh	lb.	.52 –	.....
T. N., bags	lb.	.53 –	.54

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b., Quebec	sh. ton	$500.00 –	.....
Asbestos, shingle, f.o.b., Quebec	sh. ton	$65.00 –	$85.00
Asbestos, cement, f.o.b., Quebec	sh. ton	10.00 –	14.00
Barytes, grd., white, f.o.b. mills, bbl	net ton	16.00 –	20.00
Barytes, grd., off-color, f.o.b. mills bulk	net ton	13.00 –	15.00
Barytes, floated, f.o.b. St. Louis, bbl	net ton	28.00 –	.....
Barytes, crude f.o.b. mines, bulk	net ton	8.00 –	10.00
Casein, bbl., tech	lb.	.14 –	.15
China clay (kaolin) crude, f.o.b. Ga	net ton	6.00 –	8.00
Washed, f.o.b. Ga	net ton	8.00 –	9.00
Powd., f.o.b. Ga	net ton	14.00 –	20.00
Crude f.o.b. Va	net ton	6.00 –	8.00
Ground, f.o.b. Va	net ton	13.00 –	19.00
Imp., lump, bulk	net ton	15.00 –	20.00
Imp., powd	net ton	45.00 –	50.00
Feldspar, No. 1 pottery	long ton	7.50 –	.....
No. 2 pottery	long ton	6.00 –	.....
No. 1 soap	long ton	8.50 –	.....
No. 1 Canadian, f.o.b. mill	long ton	18.00 –	20.00
Graphite, Ceylon, lump, first quality, bbl	lb.	.06 –	.06½
Ceylon, chip, bbl	lb.	.04½–	.05
High grade amorphous crude	ton	15.00 –	30.00
Gum arabic, amber, sorts, bags	lb.	.14½–	.15
Gum tragacanth, sorts, bags	lb.	.48 –	.56
No. 1, bags	lb.	1.50 –	1.60
Kieselguhr, f.o.b. Cal	ton	40.00 –	42.00
F.o.b. N.Y	ton	50.00 –	55.00
Magnesite, crude, f.o.b. Cal	ton	14.00 –	15.00
Pumice stone, imp., casks	lb.	.03 –	.05½
Dom., lump, bbl	lb.	.05 –	.05½
Dom., ground, bbl	lb.	.05½–	.06
Silica, glass sand, f.o.b. Ind	ton	2.00 –	2.50
Silica, sand blast, f.o.b. Ind	ton	2.50	5.00
Silica, amorphous, 250-mesh, f.o.b. Ill	ton	17.00 –	17.50
Silica, glass sand, f.o.b. Ill	ton	1.50 –	3.00
Soapstone, coarse, f.o.b. Vt., bags	ton	7.00 –	8.00
Talc, 200 mesh, f.o.b., Vt., bags	ton	6.50 –	9.00
Talc, 200 mesh, f.o.b. Ga., bags	ton	7.00 –	9.00
Talc, 200 mesh, f.o.b. Los Angeles, bags	ton	18.00 –	20.00

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$2.75 –	.....
Corning	bbl.	1.60 –	.....
Cabell	bbl.	1.50 –	.....
Somerset	bbl.	1.40 –	.....
Illinois	bbl.	1.67 –	.....
Indiana	bbl.	1.68 –	.....
Kansas and Oklahoma, 28 deg.	bbl.	1.20 –	.....
California, 35 deg. and up	bbl.	.83 –	.....

Gasoline, Etc.

Motor gasoline, steel bbls	gal.	$0.20½–	.....
Naphtha, V. M. & P. deod, steel bbls	gal	.19½–	.....
Kerosene, ref. tank wagon	gal.	.14 –	.....
Bulk, W. W. export	gal.	.06½–	.....
Lubricating oils:			
Cylinder, Penn., dark	gal.	.20 –	.22
Bloomless, 30@31 grav	gal.	.18½–	.20½
Paraffin, pale	gal.	.26 –	.27
Spindle, 200, pale	gal.	.20 –	.21
Petrolatum, amber, bbls	lb.	.05 –	.05½
Paraffine wax (see waxes)			

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140–145
Chrome brick, f.o.b. Eastern shipping points	ton	50–52
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks	1,000	45–47
2nd. quality, 9-in. shapes, f.o.b. wks	1,000	41–43
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	53–55
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	53–55
F.o.b. Mt. Union, Pa	1,000	45–47
Silicon carbide refract. brick, 9-in.	1,000	1,100.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N.Y	ton	$200.00 –	$225.00
Ferrochromium, per lb. of Cr, 6-8% C	lb.	.07 –	.08
4-6% C	lb.	.10 –	.12
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	117.50 –	.....
Spiegeleisen, 19-21% Mn	gr. ton	45.00 –	47.00
Ferromolybdenum, 50-60% Mo, per lb Mo	lb.	2.00 –	2.50
Ferrosilicon, 10-15%	gr. ton	43.00 –	50.00
50%	gr. ton	77.50 –	.....
75%	gr. ton	135.00 –	155.00

Ferrotungsten, 70-80%, per lb. of W	lb.	$0.85 – $0.95
Ferro-uranium, 35-50% of U per lb. of U	lb.	3.50 – 4.50
Ferrovanadium, 30-40%, per lb. of V	lb.	3.50 – 4.50

Ores and Semi-finished Products

Bauxite, dom. crushed dried, f.o.b. shipping points	ton	$5.50 – $8.75
Chrome ore Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 – 23.00
C.i.f. Atlantic seaboard	ton	21.00 – 25.00
Coke, fdry., f.o.b. ovens	ton	5.25 – 5.75
Coke, furnace, f.o.b. ovens	ton	4.25 – 4.75
Fluorspar, gravel, f.o.b. mines' Illinois	ton	23.50 – .....
Ilmenite, 52% TiO_2	lb.	.01½– .01⅝
Manganese ore, 50% Mn c.i.f. Atlantic seaport	unit	.35 –.....
Manganese ore, chemica (MnO_2)	ton	80.00 – 85.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.65 – .70
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 – .08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½– .12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.11½– .12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12
Rutile, 95% TiO_2	lb.	.12 –.....
Tungsten, scheelite, 60% WO_3 and over	unit	8.75 – 9.00
Tungsten, wolframite, 60% WO_3	unit	8.50 – 8.75
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 – 3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	2.25 – 2.50
Vanadium pentoxide, 99%	lb.	12.00 – 14.00
Vanadium ore, per lb. V_2O_5	lb.	.75 – 1.00
Zircon, washed, iron free, f.o.b. Pablo, Fla.	lb.	.02 – .10

Non-Ferrous Materials

	Cents per Lb.
Copper, electrolytic	14½–...
Aluminum, 98 to 99%	26–27½
Antimony, wholesale, Chinese and Japanese	7½– 8½
Nickel, virgin metal	27–29
Nickel, ingot and shot	30–32
Monel metal, shot and blocks	32.00
Monel metal, ingots	38.00
Monel metal, sheet bars	45.00
Tin, 5-ton lots, Straits	38.12½
Lead, New York, spot	6.50
Lead, E. St. Louis, spot	6.55
Zinc, spot, New York	6.55
Zinc, spot, E. St. Louis	6.20

Other Metals

Silver (commercial)	oz.	$0.62½
Cadmium	lb.	1.00
Bismuth (500 lb. lots)	lb.	2.55
Cobalt	lb.	3.00-3.25
Magnesium, ingots, 99%	lb.	1.25–.....
Platinum	oz.	116.00
Iridium	oz.	275.00@300.00
Palladium	oz.	80.00
Mercury	75 lb.	66.00

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	22.50
Copper bottoms	31.50
Copper rods	23.00
High brass wire	20.25
High brass rods	18.00
Low brass wire	21.75
Low brass rods	22.00
Brazed brass tubing	24.25
Brazed bronze tubing	28.50
Seamless copper tubing	27.00
Seamless high brass tubing	25.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

Copper, heavy and crucible	9.25@ 9.50
Copper, heavy and wire	11 25@11.50
Copper, light and bottoms	10.25@10.50
Lead, heavy	5.25@ 5.50
Lead, tea	3 25@3.37½
Brass, heavy	6.25@ 6.50
Brass, light	5.25@ 5.50
No. 1 yellow brass turnings	6.00@ 6.25
Zinc scrap	3.50@ 3.75

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.64	$3.64
Soft steel bars	3.54	3.54
Soft steel bar shapes	3.54	3.54
Soft steel bands	4.39	4.39
Plates, ¼ to 1 in. thick	3.64	3.64

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Arkansas

EL DORADO—The Lion Oil & Refining Co., is pushing construction on its new local oil refinery and expects to have the initial units ready for service early in the fall. The plant will have a capacity of 10,000 bbl. per day, and will represent an investment of about $2,500,000. F. H. Ehwing is president, and V. H. Smith, vice-president and general manager.

California

LOS ANGELES—The California Soap Co., has awarded a contract to V. P. Gilbert, Citizens' National Bank Bldg., for the erection of a new 1-story plant, 80x140 ft., at 2437 East 9th St. Work will be commenced at once.

MERCED—The Yosemite Portland Cement Co., is perfecting plans for its proposed local cement mill and will soon commence the construction of the initial units, to be equipped for a daily output of 2,000 bbl. The plant will be of the "wet process" type, and is estimated to cost close to $1,000,000, with machinery. C. S. Woody is vice-president in charge. Leigh Hunt, Kansas City, Mo., is engineer.

LOS ANGELES—The California Clay Products Co., recently organized with a capital of $1,500,000, will succeed to the plant and business of the present company of the same name, Santa Fe Ave. Plans are being perfected for the erection of a new plant for the manufacture of tile and kindred products at Cudahy, near Los Angeles, where a 12-acre site has been purchased. The initial works will cost $250,000, with machinery, and additional units of this same size will be built at a later date. Arthur W. Savage, R. B. Keeler and W. H. Hamaker head the company. The last noted is vice-president of the Los Angeles Continental National Bank.

LOS ANGELES—The California-Hawaiian Sugar Refining Co., has acquired property on Terminal Island, Wilmington Harbor district, and plans for the construction of a new sugar refinery, estimated to cost $250,000, with equipment.

LIVERMORE—The Oso Products Co., 1053 Mission St., San Francisco, manufacturer of soap products, has acquired a local site and plans for the erection of a new plant.

Connecticut

MANCHESTER—The Orford Soap Co., Hilliard St., has awarded a contract to the Manchester Construction Co., 953 Main St., for the erection of a new 1-story addition to its plant, 130x160 ft., and will commence work at once.

Florida

JACKSONVILLE—The Southern Soap Co., will take bids at once for equipment for installation in a local building for the manufacture of soaps, washing powders, paste, etc., to develop a daily output of about 30 tons. The installation is estimated to cost about $40,000. W. A. Evans is president.

Idaho

WALLACE—The Hecla Mining Co., is planning for the rebuilding of the portion of its surface plant recently destroyed by fire, with loss estimated in excess of $500,000. New hoisting equipment, pumping machinery and other mechanical equipment will be installed.

Illinois

CHICAGO—The Elliott Varnish Co., 1013 South Kolman Ave., will build a 1-story addition to its plant, 75x85 ft., including alterations and improvements in the present works. E. Steinborn and Louis Simon, 111 North Dearborn St., are associated architects.

CLEARING—The George H. Morrill Co., 157 West Harrison St., Chicago, manufacturer of printing inks, etc., with main plant at Norwood, Mass., has acquired a 2-acre tract of land at Clearing, as a site for the erection of a new plant, for which plans will be prepared at once. The initial unit is estimated to cost close to $75,000. Foltz & Brand, 111 West Washington St., are architects. Frederick P. Bagley is general manager.

Indiana

WHITING—The Standard Oil Co. of Indiana, Indianapolis, has arranged an extension and improvement program at its local refinery to cost in excess of $850,000. Work is in progress on a new unit to cost about $350,000, with equipment, and another unit will be constructed as soon as this is completed. Extensions will be made in the paraffin department to cost about $250 000, including machinery, and an addition built to the white oil department to double the present output, with cost estimated at $300,000.

INDIANAPOLIS—The Aquos Products Co. has perfected arrangements for the operation of a new plant at 420 West St. Clair St., for the manufacture of liquid soaps and kindred products.

Kentucky

OWENSBORO—The Owensboro Clay Products Co., recently formed with a capital of $100,000, is arranging for the erection of a new plant in the Bon Harbor section for the manufacture of hollow tile, building blocks and affiliated products. It will cost about $40,000. John A. Bolger heads the company.

Michigan

GREENVILLE—The Bennett Brass Co., lately organized with a capital of $100,000, will purchase the local plant of the Regle Brass Co., bankrupt. The new owner will take immediate possession and plans for extensions and improvements for the manufacture of brass and bronze products. Willard J. Bennett heads the new company. J. J. Siefen, formerly connected with the Grand Rapids (Mich.) Brass Co., will be general manager.

OAKWOOD—The Detroit Steel Corp. is pushing construction on its new local plant for the manufacture of strip steel, etc., and purposes to have the first unit ready for service in October. The installation of furnaces and other equipment will proceed at an early date. Other plant units will be built later. W. C. Schrage is president.

Missouri

INDEPENDENCE—The Friderichsen Floor & Wall Tile Co., has commenced work on enlargements at its plant to increase the capacity more than 50 per cent. The expansion will include a new 1-story unit to cost about $40,000, and the installation of equipment for the production of colored tile products.

ST. LOUIS—The Titanium Pigment Co., 94 Fulton St., New York, N. Y., an interest of the National Lead Co., 111 Broadway, New York, has taken title to the plant of the Mineral Refining & Chemical Corp., on the Mississippi River, near St. Louis, and will make alterations and improvements. The works will be used for the manufacture of paint pigments, and will develop to full capacity.

KANSAS CITY—The Cook Paint & Varnish Co., is planning for the early operation of its new plant unit at North Kansas City, now being completed, and purposes to develop an initial output of about 2,500 gal. per day. The extension will represent an investment of about $300,000, with machinery.

New Jersey

TRENTON—The Acme Rubber Mfg. Co., East State St., manufacturer of mechanical rubber products, tires, etc., is having plans drawn for the erection of a new 2-story building to cost about $50,000. William A. Klemann, First National Bank Bldg., is architect.

New York

NEW YORK—The Mesabi Iron Co., 25 Broad St., is perfecting plans for the construction of a new sintering plant at its works, to increase the output from 250 to 800 tons per day. Work is under way on an initial unit with capacity of 150 tons daily. The company is disposing of a stock issue of $1,572,500, the proceeds to be used for the expansion.

ROCHESTER—The Asbestos Corp., 964 Chili Ave., has awarded a general contract to the L. Goodman Co., 531 Lexington Ave., for the erection of a new 2-story plant, estimated to cost $37,000, including equipment.

GRANVILLE—The Rubberoid Co., has tentative plans for the erection of a new 1-story plant. J. Rugen heads the company.

Pennsylvania

PHILADELPHIA—Fire, Aug. 1, destroyed a portion of the plant of Delany & Co., Inc., Milnor and Cottman Sts., manufacturer of glue, adhesives, etc., with loss estimated at about $300,000, including machinery. It is planned to rebuild. The plant of the L. Martin Co., adjoining, manufacturer of lamp black, etc., was also damaged.

READING—Willson Goggles, Inc., manufacturer of optical glass products, has preliminary plans under way for the erection of a new plant on site in the vicinity of its present works, estimated to cost close to $500,000, including equipment. Dr. Frederick Willson is president.

PHILADELPHIA—The Berg Co., Ontario and Richmond Sts., manufacturer of fertilizer products, has awarded a contract to Stetson & Lukens, Terminal Bldg., for the erection of a 1-story addition to its rendering department.

PHILADELPHIA — Bachmann Brothers, 607-9 Commerce St., manufacturers of celluloid products, have awarded a contract to the A. Raymond Raff Co., 1635 Thompson St., for extensions and improvements in their plant.

NEW CASTLE—The Shenango Pottery Co., manufacturer of general ware, has tentative plans for extensions in its plant, including the installation of additional kilns. The company has arranged for an increase in capital from $250,000 to $750,000, a portion of the proceeds to be used for the expansion.

NORRISTOWN—The William Ellis Cement Products Co., recently organized, has perfected plans for the operation of a new plant in Upper Merion Township for the manufacture of cement blocks and kindred specialties. William Ellis heads the company.

Tennessee

CRAB ORCHARD—The Southland Portland Cement Co., recently organized with a capital of $1,000,000, has acquired local property and is said to be planning for the early erection of a new cement manufacturing plant, with initial annual capacity of about 1,000,000 bbl. It is estimated to cost in excess of $600,000, with machinery. Benjamin L. Ireland, Nashville, Tenn., and Louis H. Wright, Indianapolis, Ind., head the new company.

Texas

DALLAS—The Love Field Potteries, Inc., recently organized with a capital of $75,000, has commenced the erection of a new plant in the Love Field industrial district for the manufacture of art pottery and other pottery products. The initial machinery installation is estimated to cost approximately $30,000. L. S. McKamy is president, and E. T. Jackson, secretary and treasurer. The new company will operate in conjunction with the Dallas Pottery Co.

SAN ANTONIO—The Ajax Petroleum Co., recently organized, has acquired the former local plant of the San Antonio Refining Co., and will take immediate possession. Extensions and improvements will be made, including the installation of additional equipment for increased output. L. H. Coursen is president.

DALLAS—Steele, Sutton & Steele, Inc., manufacturer of ore machinery, etc., will commence the construction of a new foundry for the manufacture of fine plain carbon and alloy steel castings, estimated to cost close to $200,000, with equipment. Contract for an electric furnace has been awarded, and purchases of other equipment will be made at an early date.

AMARILLO — The Mountain States Pipe Line Co., recently organized as an affiliation of the Producers' & Refiners' Corp., California Bldg., Denver, Colo., with capital of $35,000,000, has plans under consideration for the construction of a new gasoline refining plant on local site, estimated to cost about $1,500,000, with machinery. Charles E. Sutton is general manager.

ITALY—B. W. Couch, Fort Worth, has acquired the local plant of the Italy Cotton Oil Co., and will operate the property. Extensions and improvements are being considered.

Washington

BELLINGHAM—The Roche Harbor Lime Co., has tentative plans under advisement for the rebuilding of the portion of its local plant, destroyed by fire, July 28, with loss estimated at $750,000, including machinery, mechanical shops and other operating buildings.

West Virginia

WARWOOD—The Progressive Ceramics Co., recently organized, has plans under way for the establishment of a new plant on Hazlett Ave., for the manufacture of a line of fine ceramics. The company is headed by Harry Kalin and Alec Wishnew, both of Warwood.

HUNTINGTON—The Eureka Rubber Preserving Co., has tentative plans under consideration for the erection of a new local plant for the production of special rubber preservatives. L. C. Basham, P. O. Box 511, is general manager.

Wisconsin

MILWAUKEE—The Milwaukee Coke & Gas Co., is planning for the rebuilding of the portion of its plant on Greenfield Ave., including benzol department, destroyed by fire, Aug. 1. An official estimate of loss has not been announced.

Canada

ANYOX, B. C.—The Granby Consolidated Mining, Smelting & Power Co., has tentative plans for the rebuilding of the portion of its local works recently destroyed by fire with loss estimated at $100,000.

New Companies

CHEMICAL REFINING CO. INC., Newark, N. J.; chemicals and chemical byproducts, $25,000. Incorporators: F. C. and Louis G. Arnold, and Edwin F. Speelmeyer. Representative: Francis Child, 790 Broad St., Newark, N. J.

MELLON CO., INC., Pittsburgh, Pa.; to construct and operate a cement mill; $1,200,000. Incorporators: H. F. Mellon, William J. Harley, Pittsburgh; and L. G. Eggers, Mount Lebanon, Pa. Representative: Capital Trust Co. of Delaware, Dover, Del.

ALLOYS CORP., Boston, Mass.; metal alloys; $25,000. John F. Gabel is president; and Charles T. Kellough, 60 Stone St., Belmont, Mass., treasurer.

FORNESS OIL CORP., Bolivar, N. Y.; refined oils; $50,000. Incorporators: E. W. Cady, F. Forness, and F. T. Allen. Representative: Bliss & Bliss, Bolivar.

HYDRO-ELECTRIC CHEMICAL CO., Augusta, Me.; nitrogen, phosphorus, compounds, etc.; $75,000. Incorporators: E. M. Leavitt, C. L. Andrews, and W. T. Gardiner, all of Augusta.

EDWARD GOLDMAN CO., Boston, Mass.; leather products; $100,000. Edward Goldman, 82 Fuller St., Brookline, Mass., is president and treasurer.

PERFECTION REFINING CO., Long Beach, Cal.; refined petroleum products; $1,000,000. Incorporators: F. B. Wells and D. W. Minier, Long Beach; and O. A. Burchard, Ocean Park, Cal.

UNITED STATES PAINT CO., New Orleans, La.; paints and varnishes; $1,100,000. Incorporators: R. J. Holzer, J. Raynaud and I. J. Gauthier, New Orleans. Representative: Delaware Registration Trust Co., 900 Market St., Wilmington, Del.

GARDNER PETROLEUM CO., 352 East Illinois St., Chicago, Ill.; refined petroleum products; 400 shares of stock, no par value. Incorporators: D. F. and Robert H. Gardner, and J. H. Van Brunt.

SANI PAPER PRODUCTS CO., Philadelphia, Pa.; paper goods; $100,000. Incorporators: Samuel and William Feinberg, Wilmington, Del.; and George K. Hoff, Jr., Philadelphia. Representative: Samuel Feinberg, 806 King St., Wilmington, Del.

NORTH STAR EXPLOSIVE CO., LTD., Wilmington, Del.; powder, dynamite, etc.; $40,000. Incorporators: L. N. Bent, Holly Oak, Del.; Clarence C. Gerow and Henry H. Eastman, Wilmington. The last noted is representative.

FORT DEARBORN PLATE GLASS CO., Room 1351, 230 South Clark St., Chicago, Ill.; glass products; 1,000 shares of stock, no par value. Incorporators: Harvey T. Hill, Merle B. Snyder and Raymond M. Sides.

LORAINE REFINING CO., Wilmington, Del.; refined oil products; $100,000. Representative: Corporation Trust Co. of America, du Pont Bldg., Wilmington.

IRIS CHEMICAL CO., INC., Newark, N. J.; chemicals and chemical byproducts; $50,000. Incorporators: G. A. Savage, Jacob Braverman and Charles W. Schaffer. Representative: Schneider & Schneider, 790 Broad St., Newark.

PETOSKEY OIL CO., Pearsall, Mich.; petroleum products; $100,000. Incorporators: J. E. Hobbins, Leon Leoff, San Antonio, Tex.; and Frederick Schreur, Kalkaska, Mich. The last noted is representative.

Industrial Notes

BURFORD, HALL and SMITH, American Trust and Savings Bank Bldg., Birmingham, Ala., have been appointed district representatives for the sale of Diamond Soot Blowers by the Diamond Power Specialty Corp. of Detroit.

THE GENERAL ELECTRIC CO. announces that A. S. Moody, formerly assistant Northwest manager of the company, has been appointed local manager of the Los Angeles office, to succeed R. L. Cash, who has been transferred to Schenectady. Mr. Moody has been identified with the General Electric Co. in the Pacific Coast section for the past 16 years.

THE VULCAN IRON WORKS, Wilkes-Barre, Pa., have made a change in representation at their New York office, in the Hudson Terminal Building, 50 Church Street. M. E. Davis, who has had charge of that office has gone into other lines of work. Thomas MacLachlan, of the home office, has been appointed manager of the New York office.

THE YALE AND TOWNE MANUFACTURING CO., Stanford, Conn., in view of the interest of European manufacturing centers in its new line of electric storage battery industrial trucks, has sent abroad the manager of the Truck Division, Major R. W. Chandler. He will go to England, France, Belgium, Denmark, Sweden, Norway and Holland.

THE CALORIZING CO., Pittsburgh, Pa., announce that William E. Clark has charge of this company's Michigan and Northern Ohio territory, with offices in the General Motors Bldg., Detroit, Mich.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

ASPHALT, GILSONITE. Lemberg, Poland. Purchase—7369.

COBALT OXIDE. Shanghai, China. Purchase—7359.

ENAMELS AND METALLIC OXIDES. Valparaiso, Chile. Purchase—7356.

FATS, ANIMAL AND VEGETABLE, TECHNICAL GREASES. Warsaw, Poland. Purchase—7390.

GUANO, FISH AND BIRD. Hongkong, China. Purchase.—7361.

PAINT, WATERPROOF, FOR CEMENT. Rio de Janeiro, Brazil. Purchase.—7399.

PAINTS AND VARNISHES FOR AUTOMOBILES. Christiana, Norway. Purchase and Agency.—7362.

ROSIN. Lemberg, Poland. Purchase.—7369.

ROSIN. Montevideo, Uruguay. Purchase.—7377.

ROSIN. Warsaw, Poland. Purchase.—7390.

ROSIN. Warsaw, Poland. Purchase.—7415.

CAUSTIC SODA. Montevideo, Uruguay. Purchase.—7377.

TURPENTINE. Lemberg, Poland. Purchrase.—7369.

COTTONSEED OIL, PALM KERNEL OIL, COCONUT OIL, AND FATTY ACIDS FROM THESE OILS. Galicia, Poland. Purchase.—7389.

COTTONSEED OIL AND CAKE, AND LINSEED CAKE, FATS, GREASES, ETC. London, England. Agency.—7403.

FATS AND SCRAPS, ANIMAL AND VEGETABLE. Warsaw, Poland. Agency.—7403.

TOILET SOAP. Yunnanfu, China. Purchase and agency.—7408.